FINAL PROJECT – TI 141501

SAFETY CULTURE MATURITY LEVEL FRAMEWORK DEVELOPMENT AND ITS MEASUREMENT IN LOGISTIC ACTIVITIES

(Case Study: Commercial Department of PT SMART Tbk Rungkut, Surabaya)

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APPROVAL SHEETS

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FINAL PROJECT

Proposed as a Requisite to Graduate in Industrial Engineering Major and to Achieve a Bachelor Degree in Department Industrial Engineering
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ABSTRACT

Occupational safety and health (OSH) had been the concerns in industrial company to reduce the accidents at work. Almost every day people die from occupational accidents or any work-related events. In 2017 according to the Social Security Administrator (*BPJS*) statistics, the number of accidents in Indonesia has increased about 20% from the previous year. The government has already implemented regulations concerning safety. One of the rules to control is that any company employing at least one hundred people shall apply to OSH Management System (*Sistem Manajemen K3*). However, the fact is that not all of the companies could implement the OSH procedures correctly. Further control and monitor are needed to implement effective and efficient OSH Management System in a company.

Maturity level provides a comprehensive measurement of safety performance to help a company understand its current level of performance. Safety culture has been described as the most important theoretical development in health and safety research in recent years. Safety culture covers three main aspects namely psychological, behavioral and situational aspect. This research aim to measure the safety culture maturity level in logistic activities of a manufacturing company to describe the current stage of safety culture development.

The research was conducted in Commercial Department of PT SMART Tbk. which is located in Surabaya. The safety culture questionnaire development result have the total of 35 questions representing 8 factors of safety culture. The amount of aspects was also distributed evenly. The questionnaire was proven to be valid and reliable, as shown by the value of Pearson Correlation and Cronbach's Alpha that is significant for all question items.

The assessment result in Commercial Department was shown in form of Triangular Fuzzy Number with the value 4.126, 3.138 and 4.666 for the Kernel value, Minimum value and Maximum value respectively. The Kernel value is interpreted as the company safety culture maturity level is close to the proactive level. The Minimum value is interpreted as close to the bureaucratic level. The Maximum value is interpreted as between the proactive and generative level.

The improvements are prioritized to be done in GBJ (Finished Good Warehouse) and Tank Farm (Operation) section, while the factors are Commitment and Leadership since they have the lowest value of safety culture.

Key words: safety culture, safety culture maturity level, occupational health and safety, logistic activities, questionnaire development, Triangular Fuzzy Number.

PREFACE

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During the writing of this report, author was working hard to achieve the best result. Nevertheless, if it is found any shortcomings that is author's fault, please kindly give recommendation and critics needed to improve this report.

Surabaya, July 2018

Mohammad Iqbal K G

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CHAPTER 1
INTRODUCTION

This chapter discusses the background of doing the research, research problem formulation, objectives of the research, and benefits of doing the research, the boundary of the research which consists of limitation and assumption, and the report writing structure.

1.1 Background

An occupational accident is basically seen as an unwanted or unplanned event that causes harm to people, property (assets), or processes. Heinrich (1931) defines an accident as an unplanned and uncontrolled event in which the action or reaction of an object, substance, person or radiation results in personal injury or the probability thereof. While Bird and Germain in 1966, for instance, define an accident as an unintended or unplanned happening that may or may not result in property damage, personal injury, work process stoppage or interference, or any combination of these conditions under such circumstances that personal injury might have resulted.

Almost every day people die from occupational accidents or any work-related events. The ILO (International Labor Organization) stated that more than 2.78 million labors dead each year and about 374 million non-fatal occupational accidents causing injuries and illness every year. Meaning that one in every second, a worker is injured. In 2017 according to the BPJS statistics, the number of accidents in Indonesia has increased about 20% from the previous year. It is approximately 123 thousands cases in 2017 while 106 thousand in 2016.

In *Undang Undang Nomor 1 Tahun 1970* concerning occupational safety stated that every worker is entitled to protection for his safety in doing work for the welfare and to increase production and national productivity. Occupational Safety and Health (OSH) are all activities to ensure and protect the safety and health of the workforce through prevention of occupational injuries and occupational diseases (*Peraturan Pemerintah No. 50 Tahun 2012*). Therefore a company had to

implement, manage, and control the occupational safety and health. One of the ways to do this is to implement OSH Management System. Occupational Safety and Health Management System is part of the company's overall management system in the context of risk control related to work activities in order to create a safe, efficient and productive workplace. According to *Peraturan Pemerintah No. 50 Tahun 2012* concerning the implementation of OSH Management System, there are 5 basic principles in the implementation of OSH Management System as a continuous process. They are OSH policy determination, OSH planning, plan implementation, monitoring, and evaluation, as well as review and improvement of OSH performances.

According to *Peraturan Menteri PER.05/MEN/1996* article 3 paragraph 1 about Occupational Safety and Health Management System, any company employing at least one hundred people and/or contains potential hazards posed by process characteristics or production materials that may result in occupational accidents such as blasting, fire, pollution, and occupational diseases shall apply to OSH Management System. Every company, especially in the manufacturing sector, should implement the OSH even though it is on the lower level of potential hazards. Based on the government's regulation, the national company must have already realized the system. In East Java, a total of 38,368 companies have already implemented the OSH system (Deputy Governor Saiful, 2017). However, not all of the companies could implement the OSH procedures correctly. It is recorded that the total number of occupational accidents increases up to 5% each year.

Further control and monitor are needed to realize the best implementation of OSH in a company. Measuring the safety maturity level of OSH implementation is one of the ways. Maturity Level provides a comprehensive measurement of safety performance to help a company understand its current level of performance, and the steps it can take to improve safety and profitability (Allen-Bradley, 2016).

Safety culture (behavior) is the measurement of behavioral aspects of a company, including values, priorities, attitudes, incentives, and beliefs. This element of safety maturity indicates not only how highly a company values safety, but whether the company has the behaviors that embrace safety as a core value.

Safety culture covers three main aspects as shown in figure 1.1, those are psychological, behavioral and situational (Flynn et.al, 2010).

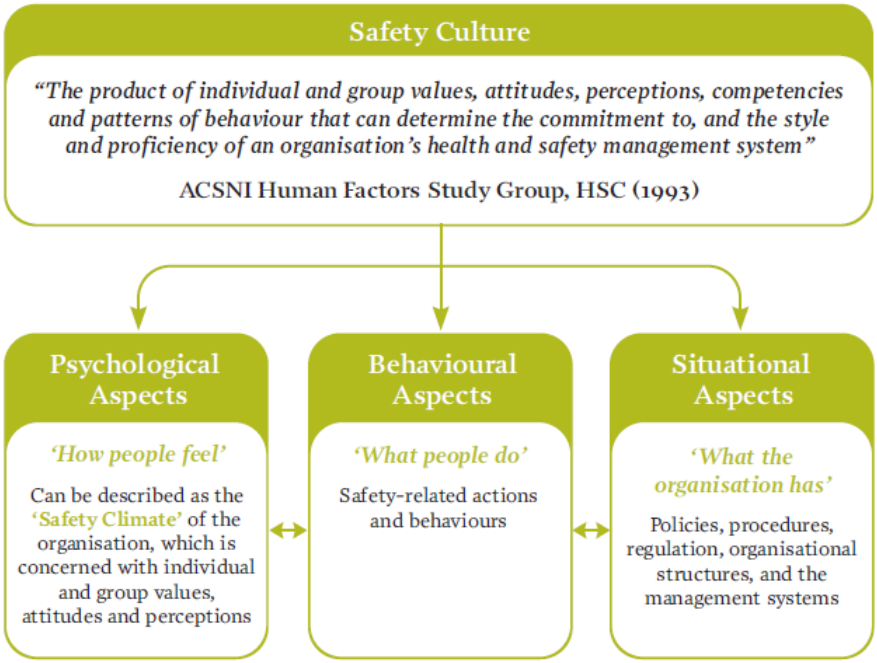

Figure 1.1 Three aspects of Safety Culture
(Source: Flynn, A and Shaw, J, 2010)

Based on *Peraturan Pemerintah No. 50 Tahun 2012* article 7 paragraph 3 about the OSH Management System policy determination, Occupational Safety and Health Policy at least contains vision, company's objectives, commitment and determination to implement the policy, and frameworks and work programs that cover the whole activities of the company. Commitment is the part of safety culture that should be implemented in every stakeholder of a company. Previously some safety experts estimate that 80-90% of industrial accidents are caused by "human factors" or human error (Hoyos, 1995). Fleming (2006) stated that an effective way to further reduce accident rate is to address the social and organizational factors that influence safety performance. In line with the more recognition of the importance of physiological aspects of safety, meaning that to look after the concept of organizational culture. Culture is the shared understanding of the organizational environment, which is held by an entire group of employees in an organization

(Ostriffm Kiniciki, & Tamkins, 2003). Safety culture has been described as the most important theoretical development in health and safety research in recent years (Pidgeon, 1992).

Recently, many industries showed a growing interest in safety culture concept as a means of potential accident reduction associated with unforeseen working situations and as in the ordinary tasks (Boughaba et. al., 2014). Safety culture is the main indicator of safety performances. They also stated that the Algerian petrochemical industry which plays an important role in the current global economic environment recognizes the pivotal effect of safety culture on safety performances. From 2004 to 2006, this sector was a field of several accidents which classified among the major accidents of the world petroleum industry (GL1k and Nezla 19). This tragedy incited business managers to introduce changes in the management system HSE and a new policy HSE was organized in 2006, especially regarding safety culture. This is the proof that even though a company has already implemented a Safety Management System, the accident prevention plans have not been effective yet.

The term safety culture has already accepted by many organizations and proven that is important to be implemented. However, only a few of organizations have successfully implemented effective safety culture that should drive into improvement initiatives (Fleming, 2016). Fleming stated that one of the reasons for this is the lack of clear guidance on what good culture looks like and how to create such a culture.

PT SMART Tbk (SMART) is one of Indonesia's leading integrated palm-based consumer products public company which committed to sustainable palm oil production. Rungkut factory is one out of five plants that operates the palm oil processing in Indonesia which is located in Surabaya. SMART Surabaya which has approximately 900 workers is a developed manufacturing company which already implemented OSH Management System. However, based on the result of the field study which was done by direct interview with one of the expert, occupational accidents were still happening. Either the minor accident or any unsafe acts were still happening. The figure 2.1 presents the occupational accident at PT SMART

Tbk in 2015 to 2017. There are 39 accidents happened in 2015, which decreased in 2016 with 13 accidents, and in 2017 also decreased to 10 accidents.

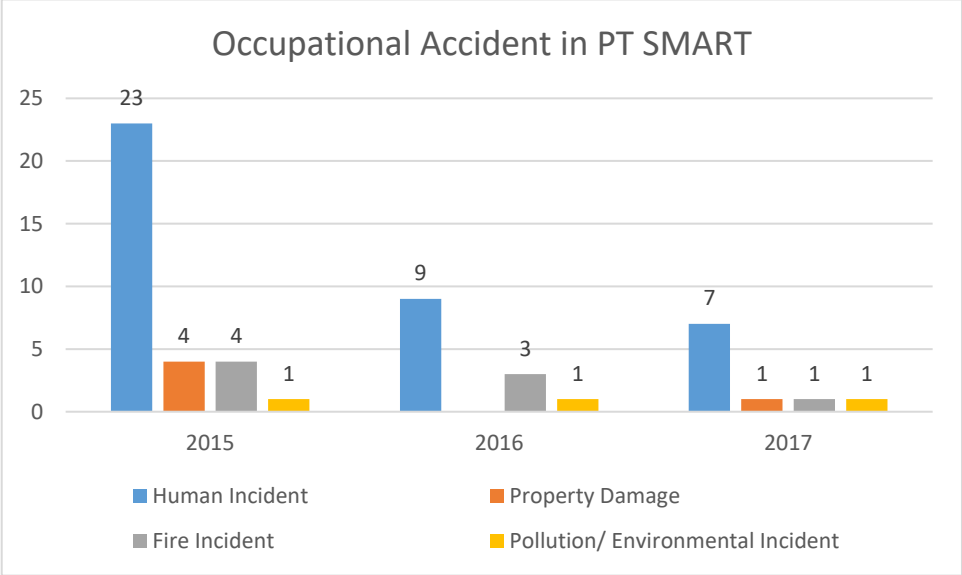

Figure 1.2 Occupational Accident in PT SMART (2015-2017)
(Source: PT SMART accident report)

Commercial department is one of the biggest and busiest department in SMART. It has approximately 182 employees (around 20% of total workers) which are divided into 6 sections. In this department, working activities are mainly done manually such as manual handling and direct interaction with tools and equipments. According to one of the heads of a section from SMART, there were several accidents happened in the Commercial department. One of the attempt to reduce the accident rate is the implementation of *SMART D'Safe* program. It is an online based database which records any unsafe activities that were happening in the company. This program used the behavioral safety approach of OSH. The company expected that every unsafe action could be recorded by anyone who saw it. The objective is to raise the awareness of the employee to always work in safety. However, SMART doesn't have any tool to measure the safety culture of the employee. According to Flynn (2010), not only the behavior aspects but also the other two aspects (psychological and situational) had to be measured. Refer to the figure 1.3, in commercial department several accidents including human incident,

property damage, fire incident and pollution/environmental incident were still happening in 2015 to 2017. These accidents may be caused by the behavior or the psychological aspects of human. Since the company has already implemented the OSH Management System.

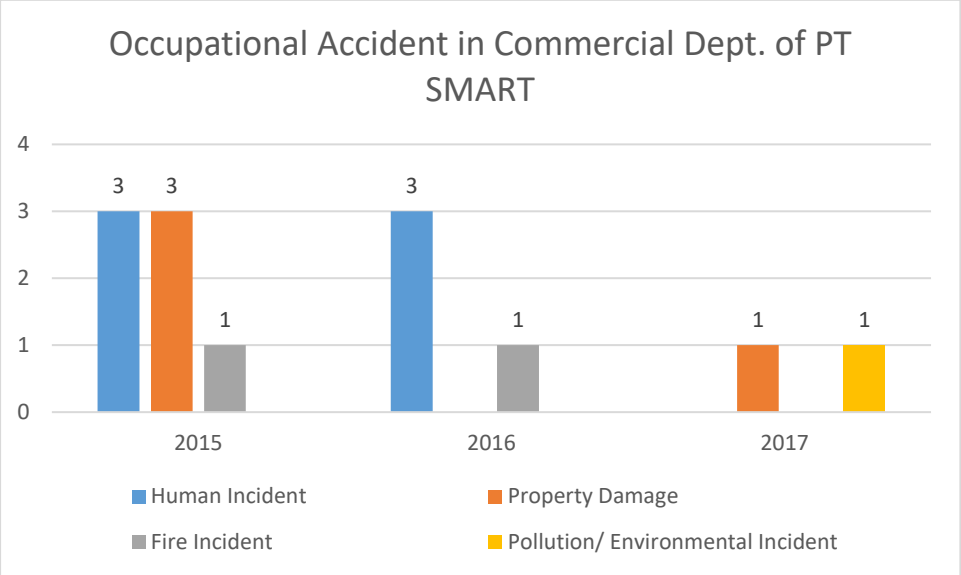

Figure 1.3 Occupational Accident in Commercial Dept. of PT SMART (2015-2017)
(Source: PT SMART accident report)

Refer to the Figure 1.1, the implementation of safety culture must concern to three aspects which consist of situational, physiological and behavioral aspects. This safety culture model in this Final Project refers to ACSNI Human Factors Study Group (1993) in Flynn (2010). Commonly many organizations that have already implemented safety culture and measure its performances (maturity) focus on the situational aspect (i.e. organizational policies, procedures, regulations etc.). The other two aspects (behavioral and physiological) were rarely measured. However, in this research, the development of the safety culture model framework concerns in safety culture entities equally. Basically, the situational aspects could be seen as a tangible asset while behavioral and psychological aspects as intangible assets. Meaning that situational aspect as an organization system is easy to be measured whereas the other two aspects are difficult to be measured. The proper

model of safety culture should be implemented in the company to measure the maturity level fairly and to give the recommendation to improve the current safety performances. Not only those aspects, there are several benefits by knowing the maturity level of a company. They are including to raise the image of the company regarding OSH implementation, as well as to raise the awareness of the importance of safety culture to comply with OSH aspects in the company.

In an attempt to answer the problem in measuring the safety culture maturity level, this Final Project adopted Hudson (2006) Safety Culture Maturity Model that described the stage of safety culture development. The maturity model concerns in three aspects which are psychological, behavioral and situational aspects. Each aspect has its own portion of the contribution to the safety culture maturity model, where every aspect has several factors of criteria. Therefore, safety culture framework in form of questionnaire was developed to be the measurement instruments tools. The questionnaire could represent the actual condition through employee perceptions in the field. The sources of measurement instruments were previously used questionnaire, literature, as well as regulations and standard guidelines. The object of the research which were going to be measured on its maturity level should be better conducted in a company as a whole. However, due to the limitations from the company, Commercial department was selected which is one of the biggest and risky department.

1.2 Problem Formulation

Based on the background that was explained, in this Final Project research, a safety culture maturity level framework is developed to measure the maturity level of safety culture which consists of psychological aspects, behavioral aspects and situational aspects in a logistic activities and to give recommendations to improve the safety performances.

1.3 Research Objectives

The following are the objectives of doing the Final Project research:

1. Develop safety culture maturity level framework consisting of psychological aspects, behavioral aspects, and situational aspects.
2. Develop safety culture maturity level measurement tool.
3. Measure the safety culture maturity level of commercial department in PT SMART Tbk.
4. Create recommendation on how to improve the safety culture performances.

1.4 Research Benefits

Below are several benefits that could be gained by the company as the object of the Final Project research:

1. Ensure the safety culture implementation in the company is not only complying with the regulations (situational aspects) but also psychological and behavioral aspects.
2. Maintain or improve the safety culture implementation based on the maturity level measurement result.
3. Raise the image of the company in terms of OSH.
4. Raise the awareness of the importance of safety culture (psychological, behavioral, and situational) in Occupational Safety and Health in a company.

1.5 Research Boundary

The research boundary is divided into two parts namely research limitations and research assumptions.

The limitations of this research are as follow:

1. The questionnaires development was applied equally to all job position of employees.
2. The safety culture measurement was limited to be done only in Commercial Department of PT SMART Tbk which consist of six sections (Terminal CPO, Tank Farm, Bulk Filling, Weighbridge, Packaging, GBJ (Warehouse of Finished Goods).

The assumptions used in this research are as follow:

1. There is no change in OSH management system and any programs regarding OSH in the company during the research.

1.6 Report Structure

The following is the systemic report writing used in the Final Project research report:

1. CHAPTER 1 INTRODUCTION

This chapter contains about the background in doing the Final Project research, the objectives of the research, the benefits of the research, and the systematic report writing of the research.

2. CHAPTER 2 LITERATURE REVIEW

This chapter contains about literature materials and theories which is used as the basis for conducting the Final Project research. The literature review was collected from some literature study, which is used to determine the appropriate method to solve the related problem.

3. CHAPTER 3 RESEARCH METHODOLOGY

This chapter contains a research methodology that consists of the stages of the research process as an attempt to solve the problem. Preparation of research methodology aims to conduct the research systematically, structured and directed.

4. CHAPTER 4 DATA COLLECTION AND DATA PROCESSING

This chapter contains the collection and processing of data to be used for data analysis and interpretation materials. Based on data collection and processing, the desired result of this research could be obtained.

5. CHAPTER 5 ANALYSIS AND RECOMMENDATION

This chapter contains the discussion of the data processing results, to be analyzed and interpreted. Analysis and interpretation of data were done in detail and systematic. Then, given a recommendation of improvement in accordance with the results of the study.

6. CHAPTER 6 CONCLUSION AND SUGGESTION

This chapter contains conclusions which answer the objectives of the research based on research results. Then, suggestions were given as recommendations and further research development materials.

CHAPTER 2
LITERATURE REVIEW

In this chapter will be discussed the literature review which supports the research process. Several theories were used such as the occupational accident definition, potential hazards at work, occupational safety and health, OSH management system, maturity level index, safety culture, safety culture maturity model, safety culture assessment framework, control and improvement strategy, and also the previous research that have been done.

2.1 Occupational Accident

In general, an accident is defined as an unplanned, unexpected, and undesigned (not purposefully caused) event which occurs suddenly and causes injury or loss, a decrease in value of the resources, or an increase in liabilities (businessdictionary, 2018). While the occupational accident is an accident that occurs in the course of a person's employment and is caused by the hazards that are inherent in, or are related to, it. OHSAS 18001 focuses on defining an incident, work-related events in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred. An accident is defined as an incident which has given rise to injury, ill health (disease) or fatality.

Generally, according to Colling (1990), there are two kinds of causes of occupational accidents, namely unsafe action, and unsafe condition. An unsafe action is workers' behavior which doesn't follow the Occupational Safety and Health (OSH) procedures and potentially dangerous, such as being careless when working, not using Personal Protective Equipment (PPE), underestimating work, placing the work equipment inappropriately, and other malicious behaviors.

While unsafe conditions are defined as inadequate environmental conditions that can cause hazards, such as dusty work environment, too hot or too cold temperature, lack of lighting, the noise, improper work facilities layout, and other conditions that potentially causing work accidents. Rahman (2005) stated that

unsafe condition can be created on machinery, equipment, materials, installation, work environment, production process, nature of work and ways of working.

Heinrich's research in the 1920s stated that 88% of the industrial accidents were caused by the unsafe act, 10% was caused by unsafe conditions, and the remaining 2% accidents couldn't be avoided. According to Colling (1990) in his research, it was also found that unsafe action is the dominant factor in occupational accidents, which is 85%. While 15% cause of the accidents is the unsafe condition. This difference is due to the workers' behaviors, which is a varied factor and difficult to control. While environmental conditions are non-moving factors that can easily be changed according to interests (Supriatna, 2015).

Heinrich in his research create the 10 axioms of industrial safety, which are:

1. Injuries result from a series of preceding factors.
2. Accidents occur as the result of a physical hazard or an unsafe act.
3. Most accidents are the result of unsafe behavior.
4. Unsafe acts and hazards do not always result in immediate accidents and injuries.
5. Understanding why people commit unsafe acts helps to establish guidelines for corrective actions.
6. The severity of the injury is largely fortuitous and the accident that caused it is preventable.
7. The best accident prevention techniques are analogous to best quality/productivity techniques.
8. Management should assume safety responsibilities.
9. The supervisor is the key person in the prevention of industrial accidents.
10. Cost of accidents include both direct costs and indirect costs

From the axioms, most of the causes of the accidents came from the behavioral aspects. The unsafe behavior, workers' commitment, unsafe actions, management system, safety responsibilities, supervising are the factors that come from the culture/environment of the organization or the company.

The domino theory of accident causation theory proposed by Heinrich (1920s) said that injuries are caused by the action of preceding factors. The unsafe acts and hazard conditions constitute the central factor in the accident sequence. When the central factor negated/removed, it would make the act of preceding factors ineffective. Then the main focus of creating good accidents prevention is in removing this factor.

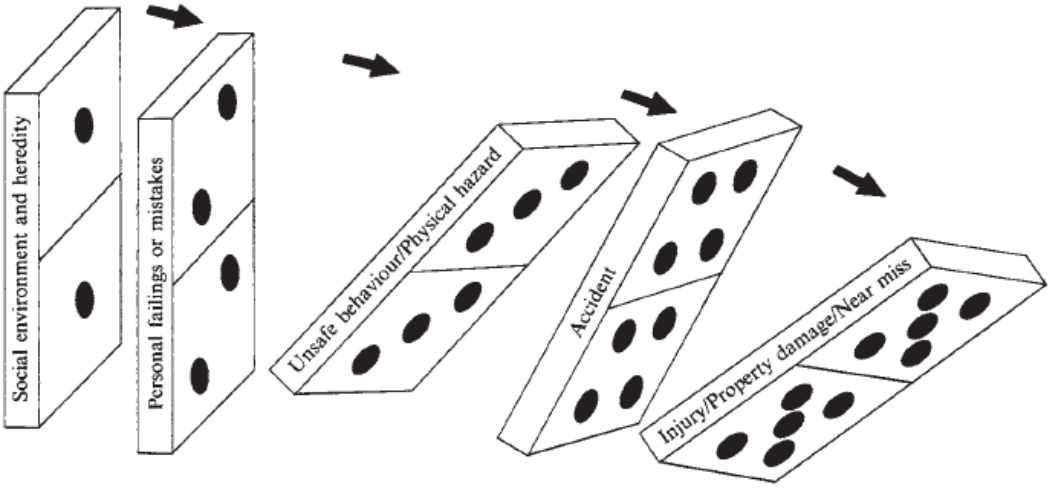

Figure 2.1 Heinrich's Domino Model of Accident Causation
(Source: Cooper, D., 2001)

2.2 Occupational Safety and Health (OSH)

Safety is traditionally seen as accident prevention, for example is to avoid unwanted events from occurring. It is also can be seen as a basic value in the workplace. Perttula and Aaltonen (2017) stated that safety is very difficult to define, safety means the state of being safe, in an example is freedom from injury or danger. While the definitions of health, in relation to work, indicates not merely the absence of disease or infirmity. It also includes the physical and mental elements affecting health which are directly related to safety and hygiene at work. Occupational safety is concerned with workers' possibility to work in such a way that their health is not harmed. Industrial safety is concerned with the prevention of industrial accidents, which can be produced, for example, by fire or by the release of hazardous chemical substances. According to Nunes (2017), Occupational Safety and Health (OSH) is

an interdisciplinary activity concerned with the prevention of occupational risks inherent to each work activity. The main aim is the promotion and maintenance of the highest degree of safety and health at work, therefore creating conditions to avoid the occurrence of work accidents and ill health.

Occupational Safety and Health (OSH) is a condition of safe and healthy work either for workers, companies, or communities and the environment around the workplace (Ridley, 1983). Meanwhile, according to Suma'mur (1981) in Djatmiko (2016), work safety is a series of activities to create a safe and peaceful working atmosphere for employees. OSH is an effort and attempts to protect and save against accident risk and danger, either physical, mental or emotional of the worker, company, society and workplace environment (Supriatna, 2015).

Based on an article by *Kementerian Ketenagakerjaan Republik Indonesia (Kemenaker)* there are three most common used OSH understanding, which are:

1. OSH definition according to Mangkunegara Philosophy

   Occupational Safety and Health (OSH) are tasks and endeavors to ensure the wholeness and perfection of the labors physical or spiritual and humanity in general as well as the work and culture of a fair and prosperous society.

2. OSH scientific definition

   Occupational Safety and Health (OSH) are the whole science and its application for the prevention of accidents, illness, fire, blasting and environmental pollution.

3. OSH definition according to OHSAS 18001: 2007

   Occupational Safety and Health (OSH) are all conditions and factors that affect, or could affect, the health and safety of employees or other workers (including temporary workers and contractor personnel), visitors, or any other person in the workplace.

In Indonesia, there are several policies and provisions that organize the regulation about the Occupational Safety and Health. This is done in attempts to maintain the rights of labors to get the safe and healthy work environment. The regulations consist of the constitution, ministerial regulations, government

regulations, ministerial decree about OSH, and also the ministerial instructions. Generally, the provisions about OSH are regulated in *Undang-Undang No. 14 Tahun 1969 tentang Tenaga Kerja* which then renewed into *Undang-Undang No.1 Tahun 1970 tentang Keselamatan Kerja.* Based on *Peraturan Pemerintah Nomor 50 Tahun 2012 tentang Penerapan Sistem Manajemen Keselamatan Dan Kesehatan Kerja,* Occupational Safety and Health, abbreviated as OSH are all activities to ensure and protect the safety and health of the workforce through prevention of occupational injuries and occupational diseases.

Based on the article 86 of *Undang-Undang No. 13 Tahun 2003 tentang Ketenagakerjaan,* it is explained that every worker/ labors have the right to obtain protection for occupational safety and health, moral and misbehavior, and appropriate treatment according to human dignity and religious values. The Occupational Safety and Health (OSH) should be implemented and organized to protect the safety of workers/ labors in order to realize the optimal work productivity. This includes the regulation of *Undang-Undang No.1 Tahun 1970 tentang Keselamatan Kerja* which stated that every worker entitled to the protection of safety in performing work for welfare and enhancing national production and productivity, also that every other person at work should be assured of his safety.

According to the International Labour Organization, OSH encompasses the social, mental and physical well-being of workers that means as the whole person. OSH is not only avoiding work accidents or occupational diseases but the result of taking actions to identify their causes (hazards existent at the workplace) and the implementation of adequate preventive OSH control measures. To accomplish such objective it is necessary to have interactions with other scientific areas, like occupational medicine, public health, industrial engineering, ergonomics, chemistry and also psychology which is concerned into behavioral, according to Nunes (2017) in OSHWiki article.

2.3 Occupational Safety and Health (OSH) Management System

Based on *Peraturan Menteri Tenaga Kerja No. PER.05/MEN/1996,* to ensure the safety and health of workers and any other people who are also at the

workplace, as well as production resources, production processes and working environment in a safe state, it is necessary to apply the Occupational Safety and Health Management System. Occupational Safety and Health Management System (OSH Management System) is part of the overall management system that includes the organizational structure, planning, responsibilities, implementation, procedures, processes and resources needed for development, implementation, achievement, review and maintenance of Occupational Safety and Health (OSH) policies in the context of risk control related to work activities to achieve safe, efficient and productive workplaces.

Based on *Peraturan Menteri Tenaga Kerja No. PER.05/MEN/1996*, the objectives and targets of the OSH Management System are to create an integrated OSH system in the workplace by involving elements of management, labors, conditions and work environment in order to prevent and reduce occupational accidents and diseases as well as creating a safe, efficient and productive workplace.

According to article 1 and 2 of *Peraturan Pemerintah No. 5 Tahun 2012* concerning Implementation of Occupational Safety and Health Management System every company which employing at least a hundred workers/ labors or has a high level of potential hazards is required to implement OSH Management System.

Basically, OSH Management System is a series of activities planning, implementation and evaluation of OSH systems in an organization. Based on article 6 of *Peraturan Pemerintah No. 5 Tahun 2012,* Arumsari (2017) in her research explained that there are 5 basic principles of OSH Management System to be implemented as a continuous process. The basic principles are shown in the following table:

Table 2.1 OSH Management System basic principles

No	OSH Management System Principles	
1	Commitment	
	a	Leadership and Commitment
	b	Preliminary Overview
	c	OHS Policy

Table 2.2 OSH Management System basic principles (continuation)

No	OSH Management System Principles	
2	Planning	
	a	Hazard Identification, Risk Assessment and Control
	b	Compliance with Legislation
	c	Determining Targets and Objectives of OSH Policy
	d	The Use of Work Indicators
	e	Establishment of Responsibility and Target System
3	Implementation	
	a	The existence of a Capability Guarantee
	b	The existence of Supporting Activities
	c	Resource Identification, Hazard Assessment and Control
4	Measurement and Evaluation	
	a	Examination, Testing (Checking), Measurement
	b	OSH Management System Internal Audit
5	Review and Improvement	
	a	Evaluation of OSH Policy Implementation
	b	Review of Objectives, Targets and OSH Performances
	c	OSH Management System Audit
	d	Evaluation of the OSH Implementation Effectiveness
	e	The need for change in OSH Management System

(Source: Arumsari, 2017)

There are provisions that must be implemented in order to implement OSH Management System (article 4 *Peraturan Menteri Tenaga Kerja No. PER.05/MEN/1996*), which include:

1. Establish OHS policy and guarantee commitment to the implementation of OSH Management System.
2. Plan the fulfillment of policies, targets, and objectives of OSH implementation.
3. Implement effective OSH policies by developing the capabilities and supporting mechanisms necessary to achieve OSH policies, objectives and targets.

4. Measure, monitor and evaluate OSH performance and do the improvements and prevention.
5. Review regularly and improve the implementation of OSH Management System continuously with the aim of improving OSH performances.

2.4 Safety Culture

The term Safety Culture was introduced by the International Atomic Energy Agency (IAEA) as a result of their first analysis into the nuclear reactor accident at Chernobyl. They stated that the Safety Culture of an organization is the product of the individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of an organization's health and safety management system (HSC, 1993).

According to Perttula (2017), safety is not a stable value. It needs not only to be maintained but also to be improved all the time. The safety culture indicates how safety practices actually are being performed in a workplace. Based on European Agency for Safety and Health at Work (EU-OSHA, 2012), the safety culture refers to the ways in which an organization’s informal aspects can influence occupational safety and health in a positive or negative way. The roots of occupational accidents may be found in the safety culture. A good safety culture has a positive influence on quality, reliability, competence, and productivity of a company. Management's role in creating good safety culture is critical.

Safety culture corresponds to a set of beliefs, perceptions, and attitudes that reflect the importance that individuals in the organization attribute to safety, for themselves at the personal level, and for the safety of others. A safety culture is created and nurtured mostly through unconscious socialization processes. It is often regarded as a social construction (Zwetsloot et.al, 2013).

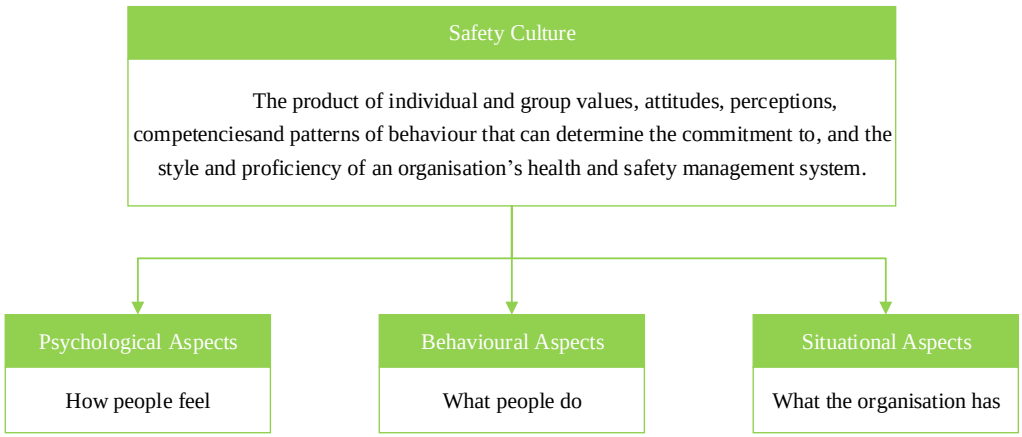

Figure 2.2 Three main aspects of Safety Culture
(Source: Flynn, A and Shaw, J, 2010)

There are three main aspects of safety culture, they are physiological, behavioral and situational aspects. Psychological aspects can be described as the safety climate of an organization. It is concerned with the individual and group values, attitudes and perceptions of the organization. Behavioral aspects describe any actions and behaviors of the people as the member of an organization that should be related to safety. Situational aspects describe the environment control of an organization. It includes the policies, procedures, organizational structure, and the management system.

Cooper (1998) identify that the organizational characteristics of a positive safety culture also emphasized the interaction between organizational systems, modes of organization; behavior and people's psychological attributes. This interactive relationship between psychological, situational and behavioral factors is applicable to accident causation chain at all levels of an organization. Cooper argued that culture actually means the product of multiple goal-directed interactions between people (psychological), jobs (behavioral) and the organization (situational). He also developed the Cooper's Reciprocal Safety Culture Model that alludes the reciprocal relationship between an organization's safety management system(s) (SMS), the prevailing safety climate (perceptions and attitudes), and daily goal-directed safety behavior.

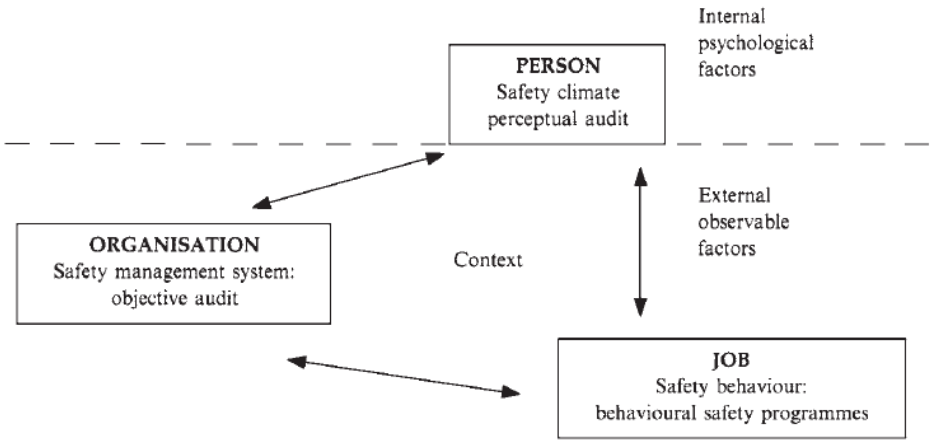

Figure 2.3 Cooper's Reciprocal Safety Culture Model
(Source: Cooper, 2001)

Safety management system in the organization represents the situational aspect of safety culture. Cooper (2001) in his book defined that safety management systems are integrated organizational mechanisms designed to control health and safety risks, ongoing and future health and safety performances, and compliance with legislation. Safety climate represents the psychological aspects which come from a person (people). The relation to others, when changes made to either organizational structures or safety management systems will impact upon people's perceptions about attitudes towards safety as well as their daily safety-related behavior. The third aspect is in the job which comes from the safety behavior. The majority of occupational accidents are triggered by unsafe behaviors, and that the control of this, is one of the keys to successful accident prevention.

The simple words which are commonly used to describe a culture in an organization are the way people do things around the company, on safety. It can be judged whether a company has a good safety culture from what its employees actually do rather than what they say. A large number of factors contribute to whether a company has a good or a bad Safety Culture. There are several main factors that indicate whether a company has a good Safety Culture, below are the list:

- Visible Management Commitment
- Good Safety Communication
- Safety over Productivity/Profit
- Learning Organization
- High Participation in Safety
- Sufficient Health and Safety Resources
- Low Level of Risk-Taking Behaviors
- Trust between management and frontline staff
- Good Contractor Management
- High Levels of Competency

A Safety Culture consists of shared beliefs, practices, and attitudes that exist in an organization. The culture is the atmosphere created by those beliefs, attitudes etc., which shape their behavior. Managers/team leaders have a key role to play in developing such a Safety Culture.

2.5 Safety Culture Maturity Model

Although the importance of safety culture is widely accepted, few organizations have successfully implemented effective safety culture improvement initiatives. One reason for this is the absence of clear guidance on what a good culture looks like and how to create such a culture. In an attempt to address these limitations Fleming (2000) developed a Safety Culture Maturity Model that described the stages of safety culture development. This model was based on previous work in the software industry. The capability maturity model enables organizations to assess their capability to reliably produce software products. The model uses an ordinal scale to outline evolutionary steps that organizations can use to measure and evaluate a number of elements involved in software production. This model is useful for organizations as it allows them to determine their current level of maturity, or the evolutionary step they are on (Paulk, Curtis, Chrissis, & Weber, 1993). Maturity models also aid in identifying an organization's areas of particular strengths or weaknesses (National Patient Safety Agency, 2006), and what actions need to be taken to reach the next level (Paulk, et al., 1993).

Fleming (2000) developed the Keill Centre (1999) safety culture maturity model which is directed to offshore oil and gas industry. It set out in a number of iterative stages. It is proposed that organizations progress sequentially through the five levels, by building on the strengths and removing the weaknesses of the previous level. It is therefore not advisable for an organization to attempt to jump or skip a level. For example, it is important for organizations to go through the managing level before the involving level as it important that managers develop their commitment to safety and understand the need to involve frontline employees.

Westrum (1984) developed a typology of an organizations culture. The typology identifies three basic styles of organizations: pathological, bureaucratic, and generative. Pathological environments develop when there is a focus on personal needs, power, and glory. Bureaucratic environments arise when there is a fixation with rules, positions, and departmental territory. Generative environments, conversely, arise when there is focus on the mission, not on persons or positions (Westrum, 2004).

Westrum (1996; 2004) proposes that this typology can be used to categorize the range of organizational culture. In pathological cultures, information is only important if it will affect their personal interests. In bureaucratic cultures information is only used to advance the goals of the department. In generative culture, an emphasis is placed on using the information to aid in accomplishing the mission (Westrum, 2004).

Reason (1993) adapted and expanded Westrum's tripartite typology, by including the characteristics of reactivity and proactivity into his typology. Reactive organizations state that safety is important to them, but respond only after accidents have occurred. Proactive organizations try to anticipate safety issues before they happen (Reason, 1998).

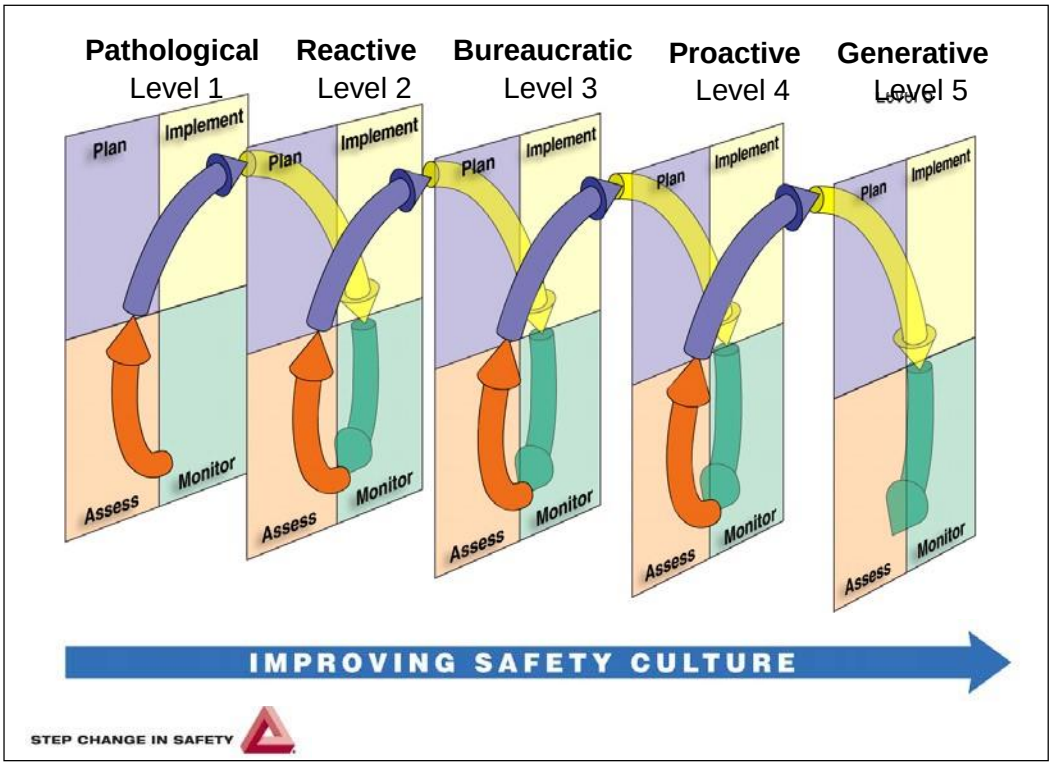

Figure 2.4 Safety Culture Maturity Model of Hudson (Hudson, 2006).

Parker, Lawrie, and Hudson (2006) created a framework for the development and maturation of organizational safety culture based on Westrum's and Reason's typologies of organizational cultures. Their model consists of five safety culture levels from Westrum's and Reason's organizational typologies: *pathological, reactive, calculative, proactive,* and *generative* (Figure 2.4). The framework is a theory-based tool that the researchers suggest could be used by companies to assess their current level of safety culture.

The descriptions of each stage of development of safety culture according to Hudson (2003) are as follows:

a. *Pathological*: safety is a problem caused by workers. The main drivers are the business and a desire not to get caught by the regulator.
b. *Reactive*: organizations start to take safety seriously but there is the only action after incidents.
c. *Bureaucratic/Calculative*: safety is driven by management systems, with many collections of data. Safety is still primarily driven by management and imposed rather than looked for by the workforce.

d. *Proactive*: with improved performance, the unexpected is a challenge. Workforce involvement starts to move the initiative away from a purely top-down approach.
e. *Generative/Sustainable*: there is active participation at all levels. Safety is perceived to be an inherent part of the business. Organizations are characterized by chronic unease as a counter to complacency.

2.6 Previous Research

The Final Project research conduction should be done correspond to previous research whether it is the method that was used, object or objectives similarity. The existence of this research was in order to fill the gap in the research knowledge. It could be either completing previous research and do improvement as well as developing the research into the higher level.

There are four previous research that encouraged the author to do this Final Project research which is presented in Table 2.2. The table shows the position of this research relative to other previous research on the similar topic. It compares based on the three aspects of safety culture.

Table 2.3 The Final Project research relative position to other research (based on aspect)

No	Research	Method	Aspect			Objective
			Psychological	Behavioral	Situational	
1	(Lawrie et al., 2005) Investigating Employee Perceptions of a Framework of Safety Culture Maturity	Development based on organizational safety culture of Westrum's			✓	Developing framework to assess organizational safety culture effectiveness
2	(Filho et al., 2010) A Safety Culture Maturity Model for Petrochemical Companies in Brazil	Developed based on Safety Culture Maturity Model			✓	Designing questionnaire to measure Safety Culture Maturity Level (Five Level)

Table 2.4 The Final Project research relative position to other research (based on aspect) (continuation)

No	Research	Method	Aspect			Objective
			Psychological	Behavioral	Situational	
3	(Kines et al., 2011) Nordic Safety Climate Questionnaire (NOSACQ-50): A New Tool for Diagnosing Occupational Safety Climate	Development based on Safety Climate dimensions	✓		✓	Designing questionnaire instruments to measure safety climate
4	(Boughaba et al., 2013) Safety Culture Assessment in Petrochemical Industry: A Comparative Study of Two Algerian Plants	Identifying the factors that contribute to a safety culture		✓		Measure the relationship between safety culture maturity and safety performance of a particular company
5	(Gusti, 2018) Safety Culture Maturity Level Framework Development and Its Measurement in Manufacturing Company	Development based on Safety Culture Aspects and Safety Culture Maturity Model	✓	✓	✓	Developing questionnaire instruments that accommodate three aspects of Safety Culture to measure Safety Maturity Level

(Source: The author's document of Literature Study collection)

The earliest research was conducted by Lawrie et al. in 2005 which discussed safety culture based on the Westruns's model. The research aims to find the tools which allow assessing effectively whether a given organization has such a positive safety culture and to help develop it if it does not. The research focuses on organizational factors in safety in developing the measurement instrument. However, the safety maturity model that was used is the basic model that would be used in this research.

The next research was conducted in 2010 by Filho et al. They discussed the similar topic with Lawrie's. They also focused on the situational aspects of safety culture and used the Safety Culture Maturity Model as the method. The difference is that this research aimed to design an original questionnaire instruments to measure the Safety Culture Maturity Level.

The other research was conducted by Kines et al. as a group of researchers from Nordic in 2011. This research has the similar objective with the Filho's research which is to design the questionnaire. However, they focused their questionnaire on the safety climate which means the psychological aspects of safety culture. The research also mentioned several points concerning organizational safety. In this research, the method used is the development of instruments based on the dimensions of safety climate.

The most recent research which was used as the reference in this research was conducted by Boughaba et al. in 2013. Different with another research, they focused the study on behavioral aspects. This research measure the safety culture maturity level of two company which then compared. They conducted the measurement based on the factors that contribute to a safety culture. This research used five-scale maturity level of safety culture.

This Final Project research relative position to others is to fill the gap that only one or two aspects were mentioned in previous research. This research focused on three aspects of Safety Culture (Psychological, Behavioral, and Situational) in order to develop the measurement instruments. It used the safety culture maturity model which consists of five level.

Table 2.3 shows another position relative to this Final Project research to others based on the factors contributing to safety culture. Most of the previous research mentioned commitment, communication, and esgagement & involvement. Kines's research (2011) focused on the safety climate took the information, organizational learning, and communication as the indicators of safety culture. Lewrie's research in 2005 only had commitment and involvement as the factors. Two literature study was also included as the reference which had the factors of commitment, communication, and involvement. Boughaba et al. in 2013 also take the similar factors to be the indicators of safety culture. There are only two research which mention four or more factors of safety culture, those are Filho et al. research and Dahl and Kangsvik research. This Final Project would take the eight factors as presented in Table 2.5.

Table 2.5 Final Project research position relative to other research (based on Factors)

No		1	2	3	4	5	6	7	8	9
Research		(Flin, et. al., 2000) Measuring safety climate: identifying the common features	(Lawrie et al., 2005) Investigating Employee Perceptions of a Framework of Safety Culture Maturity	(Filho et al., 2010) A Safety Culture Maturity Model for Petrochemical Companies in Brazil	(Kines et al., 2011) Nordic Safety Climate Questionnaire (NOSACQ-50): A New Tool for Diagnosing Occupational Safety Climate	(Boughaba et al., 2013) Safety Culture Assessment in Petrochemical Industry: A Comparative Study of Two Algerian Plants	(Dahl & Kongsvik, 2017) Safety climate and mindful safety practices in the oil and gas industry	(Flynn, A and Shaw, J, 2010) Safety Matters! A Guide to Health & Safety at Work	(HSE, 2002) HSE Human Factor Briefing Note No. 7: Safety Culture	(Gusti, 2018) Safety Culture Maturity Level Framework Development and Its Measurement in Manufacturing Company
Method		Development based on Safety Climate dimensions	Development based on organizational safety culture of Westrum's	Developed based on Safety Culture Maturity Model	Development based on Safety Climate dimensions	Identifying the factors that contribute to a safety culture	Developed from the components of safety behavior	Literature study	Literature study	Development based on Safety Culture Aspects and Safety Culture Maturity Model
Factor	Commitment	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Leadership	✓			✓		✓			✓

Table 2.6 Final Project research position relative to other research (based on Factors) (continuation)

No		1	2	3	4	5	6	7	8	9
Factor	Responsibility	✓			✓		✓			✓
	Engagement & Involvement		✓	✓		✓	✓	✓	✓	✓
	Risk	✓			✓					✓
	Competence	✓	✓		✓		✓			✓
	Information & Communication			✓	✓	✓		✓	✓	✓
	Organisational learning		✓	✓	✓					✓
Objective		Assess the safety climate	Developing framework to assess organizational safety culture effectiveness	Designing questionnaire to measure Safety Culture Maturity Level (Five Level)	Designing questionnaire instruments to measure safety climate	Measure the relationship between safety culture maturity and safety performance of a particular company	safety climate related to safety practices	Provides the measurable factors of safety culture	Provides good safety culture indicators	Developing questionnaire instruments that accommodate three aspects of Safety Culture to measure Safety Maturity Level

(Source: The author's document of Literature Study collection)

CHAPTER 3
RESEARCH METHODOLOGY

In this chapter will be presented about the design of research methodology that will be used as a reference in conducting the Final Project research.

3.1 Problem Identification and Problem Formulation Phase

This phase is the early identification phase. In this phase, literature study and field study was done. The literature reviews several theories covering occupational accident, occupational safety and health (OSH), OSH Management System, Safety Culture, Safety Culture Maturity Model, as well as previous studies (research). The field study was done by doing a direct interview and doing an observation on the current implementation of safety culture in the company.

3.2 Data Collection and Processing Phase

Data collection and processing phase consists of four main sub-phases.

3.2.1 Safety Culture Maturity Framework Development

The first sub-phase is the construction of Safety Culture Maturity Framework. Resources of studies about Maturity Model was collected and then formed into a diagram of Maturity Level. The model of safety culture maturity level from Hudson (2001) which then developed by Filho et al. (2010) would be used in this research. The five levels, from the lowest to highest level, were described as follow:

1. *Pathological*: workers are the cause of the safety problem, people should look after themselves, the mindset to avoid the safety as long as they don't get caught.
2. *Reactive:* safety is started to be taken seriously by the organization, but the action would be done after the accident had happened.

3. *Calculative/Bureaucratic:* safety has already driven by Management System to manage all hazards. Management is primarily driving safety and make it be regulations which should be followed by the employee.
4. *Proactive:* the performances have already improved. The anticipation of safety problem was made before they arise. The employee starts to have involvement and initiative.
5. *Generative/Sustainable:* active participation occurs at all levels in the organization. OSH has already been seen as the way the company does business around.

After the Maturity Level has already been determined the aspect of safety culture would be determined. In this research, three main aspects of safety culture were used. According to ACSNI in the Flynn (2010), those are the psychological aspect, behavioral aspect, and situational aspect. They are defined in the following way:

1. *Psychological:* the safety climate of an organization. It concerned with the individual and group value as well as attitudes and perceptions. It answers the question of "How people feel?"
2. *Behavioral:* all actions which are related to safety. It concerned with the patterns of behavior. It answers the question of "What the people do?"
3. *Situational:* it concerned mainly with the management system, the policies, rules, and procedures, as well as organizational structure of the company. It answers the question of "What the organization has?"

Based on the previous research and literature, an aspect should have several determinant factors. The next step is the determination of factors of safety culture. Factors determination was done by combining and simplifying from several resources. The factors being used in this research, based on the previous research that has been presented in chapter 2, consist of eight main factors of safety culture. According to several literature and research, those factors are described as follow:

1. *Commitment:* support is given by organization (OSH concerned), such as rules and procedures, planning, auditing, competency, and training.
2. *Leadership:* Describes the leadership of a supervisor or the superior who could influence the worker's safety performance at work. All level of managers (including senior supervisors) are very concerned about the OSH aspect which could be proved by their consistency in the application and behavior of OSH in the field.
3. *Responsibility:* Describe the level of employee responsibility which is characterized by a sense of care and concern in maintaining the health and safety of themselves and others in the workplace.
4. *Engagement and Involvement:* how the organization leads the employee in the participation of safety issues, accident analysis, reviewing procedures and rules, safety meeting, safety committees.
5. *Risk:* It is a potential loss that can be caused when in contact with hazard or the failure of a function.
6. *Competence:* Describe the ability of the employees at work based on their job description which concerns to safety aspects.
7. *Information and Communication:* The communication channel in the company between managers and employees, as well as between employees themselves. Concerning open and frequent communication, and social interactions. Organization's formal system that allows its employee to inform about any near miss and accidents, also the confidence of the employee. It is also complying with the shared perceptions among employees.
8. *Organisational learning:* also called as learning culture, the way the organization deals with the information, how organization analyzes the accident and near miss, and employee keeps informed about these.

After the factors have been determined, the indicators of safety culture would be determined. These indicators are the characteristic of each factor in the safety culture aspect. Each factor would have at least one indicator of safety culture.

The next step is to construct the questionnaire items based on maturity level model as the parameter (five leveled scale). At the survey, the respondents were required to select one item that best represented the position of their company in each question. The output of this sub-phase is Safety Culture Maturity Framework in form of a questionnaire. This framework describes how each one of the factors in every part of the three aspects is treated in each of the five stages of the Safety Culture Maturity Model.

Before going to the assessment process, the questionnaire would be tested using validity and reliability test. The validity test aims to ensure that the questionnaire developed truly represent the researcher purpose. The reliability test need to be done to determine whether the questionnaire instruments has good consistency that it would produce the same result when a test is done for the second time.

3.2.2 Safety Culture Maturity Level Assessment in the Department

The second sub-phase is the assessment of safety culture maturity level in the commercial department. The assessment was done in each section of the commercial department. The questionnaire was distributed using the cluster and stratified random sampling. Firstly, the number of the sample in one department would be determined. Then each of the section would have the portion of sample size based on the section population (clustering). In one section, the questionnaire would be distributed using stratified sampling.

3.2.3 Safety Culture Maturity Level Calculation

The third sub-phase is data recapitulation and data processing, meaning that safety culture of the company in one department would be calculated. Data adequacy test would be used to determine whether the data collected from the questionnaire is sufficient. Before it went to the data processing, it was needed to make sure that the data are valid and enough. Any outlayer data should be removed and it is also possible that data collection would be done again in order to complete the lack of data needed.

Maturity level calculation was using the Triangular Fuzzy Number (TFN) approach. Each section would have three aspects values as mentioned before.

Aspect value is the TFN of all factors in related aspect, the data used in each section for sections' aspects value while the entire data included for department aspects value. Thus, every section would have the maturity level of safety culture based on each aspect and as a whole. These processes would be done in every section of the commercial department. The equation below shows the formula to calculate the section aspect value, section maturity level, and section factor value using TFN.

$$Section_i\ Aspect\ Value_k = \bar{x}\ (Data_{ij}\ Aspect\ Value_k) \quad \text{..... (3.1)}$$

$$Section_i\ Maturity\ Level = (w_1 \times TFN\ Section_i\ Aspect\ Value_1) + (w_2 \times TFN\ Section_i\ Aspect\ Value_2) + (w_3 \times TFN\ Section_i\ Aspect\ Value_3) \quad \text{..... (3.2)}$$

$$Section_i\ \ Factor_j\ Values = \bar{x}\ (Data\ Section_i\ Factor_j\ Values) \quad \text{..... (3.3)}$$

Department safety culture maturity level would be calculated by using the Triangular Fuzzy Number (TFN). Department maturity level consist of three aspect, psychological, behavioral and situational. Each of these aspect would be calculated its TFN value. Then the TFN maturity level of the department would be the combination of those aspect based on their determined weight. The equation below shows the formula to calculate the department aspect value, department maturity level, and department factor value using TFN

$$Dept.Factor_j\ Values = \bar{x}\ (Data\ Factor_j\ Values) \quad \text{..... (3.4)}$$

$$Psychological\ Maturity\ Level = TFN(Psychological\ Aspect\ Values) \quad (3.5)$$

$$Behavioral\ Maturity\ Level = TFN(Behavioural\ Aspect\ Values) \quad \text{..... (3.6)}$$

$$Situational\ Maturity\ Level = TFN(Situational\ Aspect\ Values) \quad \text{.....(3.7)}$$

$$Department\ Maturity\ Level = (w_1 \times TFN\ Psychological\ Maturity\ Level) + (w_2 \times TFN\ Behavioral\ Maturity\ Level) + (w_3 \times TFN\ Situational\ Maturity\ Level) \quad \text{..... (3.8)}$$

3.3 Data Analysis and Recommendation Phase

In this phase, discussion regarding the analysis and interpretation of the result of data processing in the previous phase would be done. The analysis and interpretation cover the analysis of safety culture maturity level framework development, analysis of safety culture maturity level in each aspect, analysis of safety culture maturity level in each section, and analysis of commercial department safety culture maturity level. This phase also discussed the improvement recommendation for better safety culture implementation.

3.4 Conclusion and Suggestion Phase

Conclusion and suggestion phase is the last phase of the research. The conclusion of the research would answer the objectives that have already mentioned in chapter 1. Moreover, the suggestion would be given for the development of the next research regarding safety culture maturity level.

3.5 Research Flowchart

Research flowchart explained the methodology of the research. Research methodology is shown in the following figure.

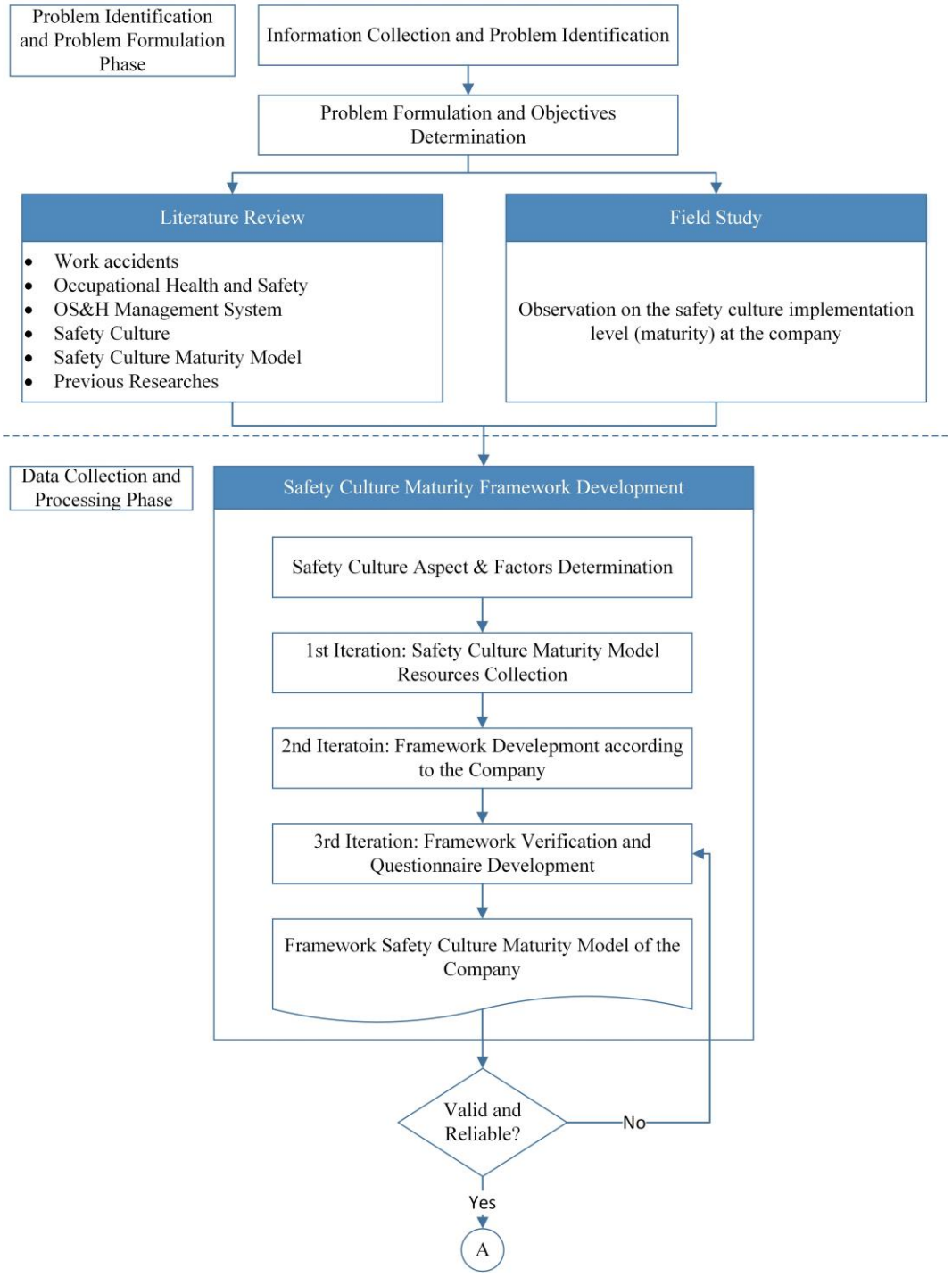

Figure 3.1 Research flowchart

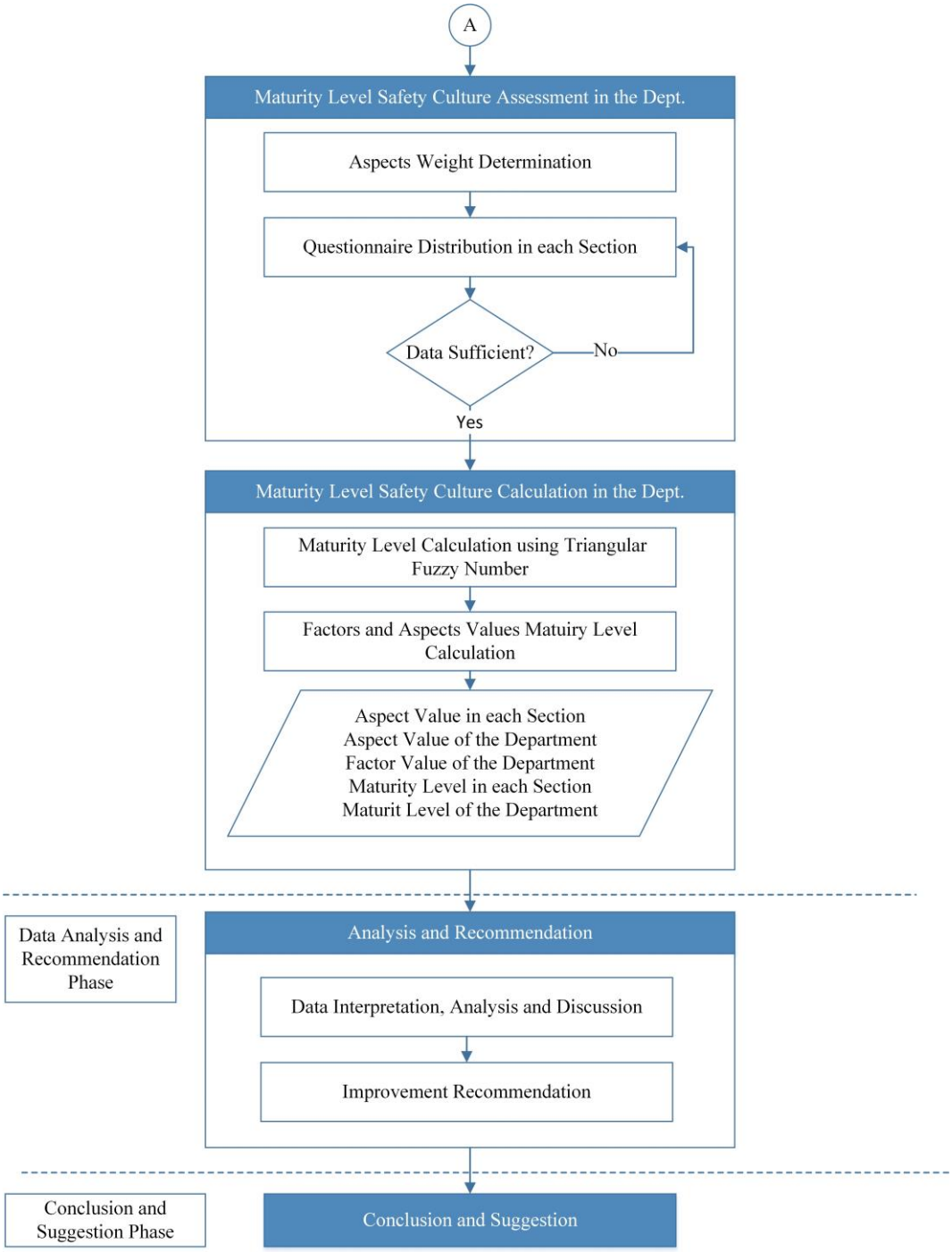

Figure 3.1 Research Flowchart (continuation)

CHAPTER 4
DATA COLLECTION AND DATA PROCESSING

In this chapter will be discussed about the data collection and data processing process. These consist of the general overview of PT SMART Tbk as the research's object, framework development of safety culture maturity level, the assessment result in Commercial Department of PT SMART.

4.1 Company General Overview

This subchapter explains the general overview of PT SMART Tbk as the object of the research. The discussion consist of the company general profile, overview of commercial department, and OSH in the company.

4.1.1 Company General Profile

PT Sinar Mas Agro Resources and Technology Tbk (abbreviated to PT SMART Tbk) is one of Indonesia's leading integrated palm-based consumer products public company which committed to sustainable palm oil production. The SMART palm oil farm cover more than 138.000 hectare. The main activities are plantation, harvesting, fresh fruit bunches (TBS) processing become Crude Palm Oil (CPO) and Palm Kernel Oil (PKO), and CPO processing to be industrial product such as cooking oil, margarine and shortening. There are fifteen factory which process TBS into CPO and KPO, with the total capacity of 4,1 million ton per year. The KPO is also processed further in the special factory which process the oil kernel with the capacity of 480 thousands ton per year. This produces palm kernel oil and kernel oilcake which have higher product value.

Rungkut factory is one out of five plants that operates the palm oil processing in Indonesia which is located in Surabaya. SMART Surabaya which has approximately 900 workers is a developed manufacturing company which is located in industrial are SIER (Surabaya Industrial Estate Rungkut). PT SMART Tbk also sell and export their product which are palm oil based. Besides the bulk oil and industrial palm oil, the company also have branded product namely Filma,

Kunci Mas and others. Currently these brands are commonly seen as a good quality product and having their own significant market share in Indonesia.

The business process of PT SMART generally process the raw material in form of Crude Palm Oil (CPO) into branded consumer goods and also bulk palm oil as well as industrial palm oil. The raw material is delivered from Sumatra and Borneo which are directly supplied from the farm of Sinarmas Group. The production process of oil palm are generally in the following order:

1. Oil Refinery Process
    a. Degumming or deslimming process to remove sap and dirt from CPO.
    b. Bleaching Process: this process aims to remove the pigment and eliminate the remaining impurities in CPO.
    c. Pack Column Process: it is basically an evaporation process treated to CPO.
    d. Deodorization Process: this is the process of elimination of fatty acid and other odorous substances by using distillation method.
2. Fractionation Process

    This process aims to separate between the liquid and solid phase contained on the palm oil. There two main processing namely Crystalisation Process and Heat Filtration Process. The output of this process are separated into two part, Stearing for solid result and Olein for liquid. Stearing will be processed to become margarine while Olein will become the oil.
3. Filling and Packaging Process

    This process cosist of several continuous oil processing steps. These process start from the storage tank farm, heat exchanger, filling plant, capping plant, labelling and packaging plant, and finally stored in finished good warehouse (GBJ).

4.1.2 Commercial Department

Commercial Department of PT SMART Tbk is mainly take part in business process after the production process. This department occupy several jobs concerning logistics, storaging, warehouse and transportation. The department organisation structure is shown in the Figure 4.1.

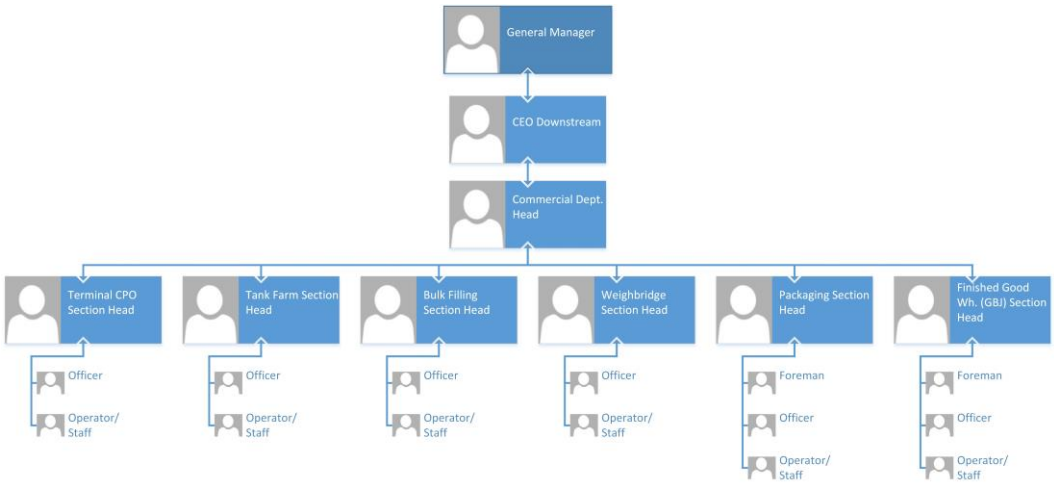

Figure 4.1 Commercial Department Organisational Structure

There are six sections under the Commercial department. Operation Terminal CPO, Operation Tank Farm and Operation Bulk Filling is a section which do their jobs in the operational area. Terminal CPO is the section which responsible for receiving the raw material of palm oil in form of CPO. Operation Tank Farm operates the storaging of the product during and after the production process. Operation Bulk Filling is the section which responsible for bulk product of oil palm. It operates for storaging and product filling to customer. Weighbridge is the weighting process of any transportation going in and out of the company. It is also integrated with the transportation of PT SMART. Packaging section is responsible for packing the product of palm oil aside from the bulk product. This section cooperates with GBJ (Finished Good Warehouse) section to package and store the product at the warehouse of the company. GBJ is also responsible for the product release to the customer.

Commercial department is one of the biggest and busiest department in PT SMART. There are many working activities which are categorized as operational

jobs. This department have higher risk level than several other department. Even though there are already preventive actions and plans, and also the implementation of behavior based safety (SMART D'Safe program) as well as the regulations from OSH Management System at the company, accidents were still happening. Commercial department contributes high rate of work accidents to the company. Table 4.1 and Table 4.2 show the record of accidents happened in Commercial Department from 2015 to 2017. The terms used in Table 4.1 are FAT, LTI, MTC and FA which are abbreviated for Fatality, Lost Time Injury, Medical Treatment Case and First Aid. While in Table 4.2 the abbreviation of PD, FI, and PEI are Property Damage, Fire Incident, and Pollution/Environment Incident respectively.

Table 4.1 Human Incident in Commercial Department (2015-2017)

	Work Area	Accident	Impact	Cause	Severity
2015					
1	Tank Farm	Slip/Collide	Wounded	In a hurry	First Aid
2	GBJ	Dust get in the eye	Eye irritation	Did not wear PPE (safety glasses)	MTC
2016					
1	Tank Farm	Oil splashed	Minor pain	Unsafe condition	First Aid
2	GBJ	Knocked by machine	Wounded leg	Human Error	MTC
3	GBJ	Knocked by forklift	Moderately wounded	Human Error	LTI
2017					

(source: PT SMART D'safe record and accident record)

Table 4.2 Incident at Work Environment and Facilities of Commercial Department (2015-2017)

	Work Area	Accident	Impact	Cause	Type
2015					
1	GBJ	Fallen pallete	glass door was broken	Pallete fallen because of the stack is too high	PD

Table 4.2 Incident at Work Environment and Facilities of Commercial Department (2015-2017) (continuation)

	Work Area	Accident	Impact	Cause	Type
2	GBJ	Fall and crash	Forklift damaged	fall, broken hand brake	PD
3	GBJ	Crash	Dent of Container box	Broken hand brake	PD
4	Tank Farm	Fire	Pump damaged	Pump clutch is loose	FI
2016					
1	GBJ	Fire splash		Pinched socket cable	FI
2017					
1	GBJ	Electrical equipment failure	Forklift battery damaged	Heated	PD
2	Tank Farm	leakage	oil gets into the sewage line	porous pump	PEI

(source: PT SMART accident record)

4.1.3 Occupational Safety and Health in the Company

There are several explanation concerning OSH in PT SMART Tbk. Those includes the EHFS section of the company, regulations and programs of OSH, monitoring in work environment, OSH management system as well as hazard identification and its impact in work area.

4.1.3.1 EHFS Section

The Occupational Safety and Health unit in PT SMART is called as EHFS (Environment Health Fire and Safety). This section is led by a section head which has one officer and three inspector. The company cooperate with outsourcing party for the responsibility of Health unit. This unit consist of an officer and paramedic. Figure 4.2 shows the organisation structure of EHFS in PT SMART Tbk.

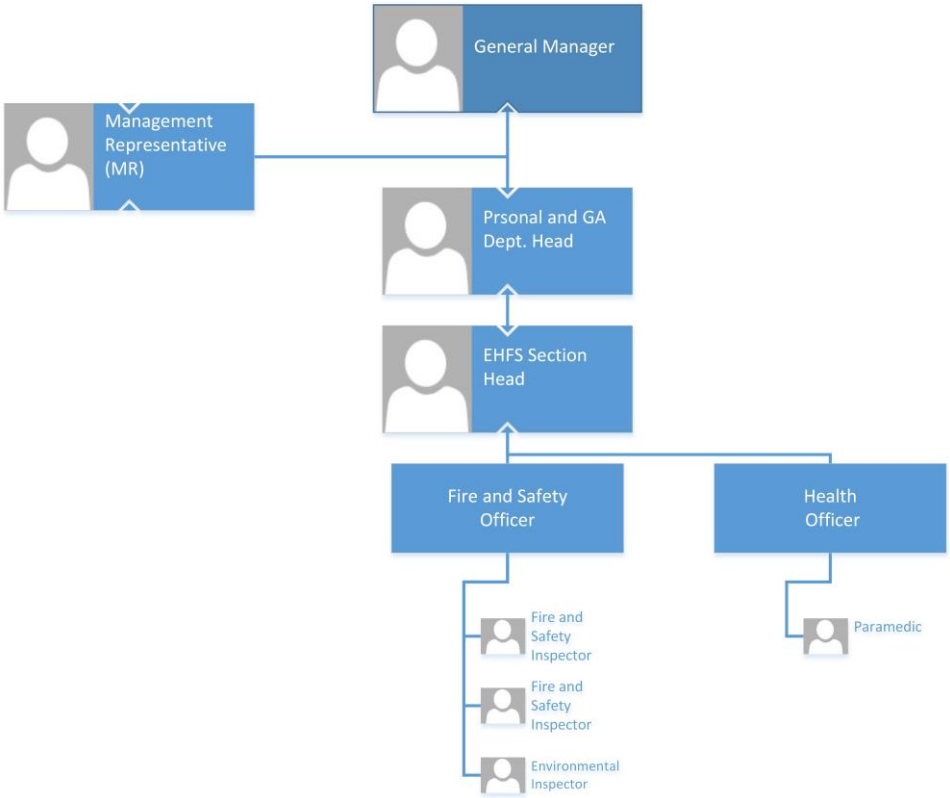

Figure 4.2 EHFS Organisational Structure

4.1.3.2 Programs and Regulations of OSH

Regulations concerning OSH in PT SMART Tbk represented in form of commitment which is signed by the General Manger. The company as a consumer goods manufacturer committed to do the environment protection including prevent the environmental pollution, fire, and occupational accident caused by working activities. They also obey to the government regulations concerning OSH, and other policies related to any operational activities at the company. As an action to realise continuous improvement in the field of environment, occupational safety and health as well as to accomplish company's vision and mission, PT SMART make several commitments as follow:

1. Conduct preventive and improvement acts towards unsafe condition and unsafe action that could cause pollution to environment, fiere, accidents, as well as occupational illness.

2. Provide training and education for employee to increase their awareness and concern towards preventive action of accident and environment pollution.
3. Conduct observation of work behavior to the entire employee and related parties as a part of work in safety establishment.
4. Implement clean production process and optimize the consumption of raw material, energy and resources efficiently.
5. Ensure the work is done according to the standard operational procedure (SOP) to prevent the occurrence of environment pollution, fire, accidents, and occupational illness.

These regulations are open to public and it must be socialized to the entire employee and related parties to be the framework in performing the routine operational activities. The five commitment are applicated into safety programs which are planned annually.

4.1.3.3 OSH Management System

There are several aspect of discussion regarding OSH Management System in the company. The following are several points about the implementation of OSH Management System in the company:

1. Constructing and Maintaining the Commitment

   This point discuss about the construction of formal regulations from the company regarding environment, fire and OSH. Responsibility and the authority to act upon safety is also regulated. The company implement behavior based safety that everyone should applicate the OSH aspects. Review and evaluation are also conducted in the company, as well as the participation of the workforce in implementing the OSH Management System.

2. Documenting Strategy

   This documenting means the strategic planning of OSH in the company, the availability of OSH Manual in every work area and work process and also regulate about the information dissemination concerning safety problem in the company.

3. Design and Contract Review

Design review is the evaluation and review of the planning of work design concerning OSH in the company. The contract review is conducted for every parties cooperating with the company, to decide whether they have already comply with OSH aspects or not.

4. Document Control

This point concerns to the agreement and document release as well as the document adjustment and modification.

5. Purchasing

Purchasing of tools and equipment of safety are needed to be managed. To verify, control, and monitor the OSH tools and equipment required at the work area.

6. Work Safety based on OSH Management System

The work system, supervising, selection and personal placement, work environment, maintenance, repairment and changing of production facilities, services, readiness towards emergency condition, first aid procedures are the things required to be arranged by OSH Management System.

7. Monitoring Standards

These monitoring activities include hazard examination, work environment monitoring, inspection tools, measurement and checking, health control. All of them has the standards to be achieved, which are already regulated in OSH Management System.

8. Reporting and Deficiency Improvement

There two types of reporting, namely emergency report and incident report. After the report, investigation procedures will be conducted and the result will be the consideration of handling the problem.

9. Material Management and Its Handling

Several things related to material management, such as the method used (manual and mechanical), handling system, storage system and material

disposal. There is also special handling and treatment for hazardous materials.

10. Data Collection and Utilization

Any record such as notes, reports data and others data concerning OSH in the company will be managed according the OSH Management System.

11. OSH Management System Audit

There is an internal audit of OSH Management System in the company which are conducted regularly especially concerning the OSH programs.

12. Skills and Competences Improvement

The regulations of training strategy, conducting the training for management, supervisor, and employee. The training are also done for visitors and contractor. Special skills training for the employee are also available.

4.1.3.4 Hazard Identification and Its Impact in Work Area

The company regularly, scheduled and as required conduct the hazard identification in the entire work area at PT SMART. The method used is HIRA (Hazard Identification Risk Assessment) to not only identify but also assess their risk possibilities and the impact.

4.2 Framework Development

This subchapter discusses about the development of Safety Culture Maturity Level starting from defining the aspects and the factors determination, defining maturity level parameter, three iteration of the framework development which also include the questionnaire development.

4.2.1 Safety Culture Aspect and Its Factors Determination

The aspects are the category of the assessment considerations from various points of view. This determines the perceptions of the category of the measurement instruments (questionnaire items). There are three aspects of safety culture which are treated equally in the assessment process in this research. Those are psychological aspect, behavioral aspect, and situational aspect. Defining the aspect

correctly and clearly is required as the standard parameter which is used to develop the measurement framework of maturity level. Clear definition of each aspect will distinguish between the aspects to avoid misconception in the questionnaire development. The definition as the reference is shown in the table below.

Table 4.3 Safety Culture Aspect Definition

Aspect	Definition of reference	Reference
Psychological Aspect	Measure the perception of an individual (respondent). Answer the question of what people feel.	(Flynn & Shaw, 2010)
Behavioral Aspect	Measure the action of respondent and/or the action of other parties. Answer the question of what people do.	(Flynn & Shaw, 2010)
Situational Aspect	Measure what there are (owned) in the company. Answer the question of what the organisation has.	(Flynn & Shaw, 2010)

The main concept of the three aspects are that psychological aspect comply with the perception from the point of view of individual as a respondent, the behavioral aspect comply with the real action which is based on the daily working activities either for respondent himself and also for other person or people, the situational aspect comply with anything from the company that has been managed such as regulations, policies, rules and others regarding safety.

Other than the aspects which define the safety culture entities, there are also factors which are used as the parameter for measurement in safety culture maturity. Unlike the aspects, the factors are part of the safety culture itself which could be measured. It is used as the assessment considerations which the company has in their existing management or organisation system. Aspects and factors are the cross functional representation of safety culture maturity in a company.

Based on the research gap that has been explained in the literature review, the factors are treated differently between one to others. To be more specific in measuring the factors, would lead to a better result interpretation which could help

to determine the improvement plan accurately. Refer to the Table 2.5, It presents literatures of safety culture with the factors concerned. Flin et. al. (2000) in his reasearch concerning to identify common features to measure the safety climate, stated that the most typically assessed dimensions/factors in safety climate, relate to management/supervision, the safety system, risk, and additional factors related to work pressure and competences. The management or supervision would be called as leadership factor while safety system is the commitment of the company and the work pressure is related with responsibility. This research would be the main literature study used to determine the factors of safety culture. While the other research were to support and add other common factors that should be measured as part of safety culture.

Filho et. al. (2010) conducted a research of safety culture maturity model which is designed to measure five aspects of organisational safety indicative. The aspect term here is the dimension/factors of safefty culture. Those factors are information, communication, involvement, commitment and organisational learning. Commitment is one of the important factor in safety climate as stated in Flin's research. Information and communication would be included in measuring the safety culture since it is common factor from four research which have been done. These two factors will be combined as one factor indicative because of the type similarity. Involvement (engagement) is also another common factor which have already used by all of the literature mentioned, except from Flin.

Lawrie et. al. (2005) in his reasearch about employees perceptions based on safety culture maturity framework consider several factors basaed on a general organisation type. Those are the workforce competency and training, commitment level, repercussion & feedback after accidents and audits & review. Accidents feedback and its response are the indicators of learning culture in an organisation. Kines et. al. (2011) develop Nordic safety culture maturity model which focus in almost all of the common factors except involvement. This research aim to design tool for diagnosing occupational safety climate in common industries. It is stated that learning culture and reporting culture are part of organisational climates.

The result of literature study, there are a total of eight factors of safety culture, which had to be measured. Namely commitment, leadership, responsibility, engagement & involvement, risk, competence, information & communication, as well as organisational learning. Each factor should have clear definition to help determine their indicator and measurement instruments in every factor. The operational definition of those factors are as follow:

Table 4.4 Safety Culture Factors Operational Definition

Factors	Operational Definition	Reference
Commitment	The company's support for health and safety aspects which includes planning, prioritization, training, audit, awards, investments, procedures, and team building. Honesty of commitment is more meaningful than a written statement that calls safety and health is important.	(Filho, et al., 2010) ; (Dahl & Kongsvik, 2017)
Leadership	Describes the leadership of a supervisor or the superior who could influence the worker's safety performance at work. All level of managers (including senior supervisors) are very concerned about the OSH aspect which could be proved by their consistency in the application and behavior of OSH in the field.	(Lingard, et al., 2013) ; (Fleming, 2001)
Responsibility	Describe the level of employee responsibility which is characterized by a sense of care and concern in maintaining the health and safety of themselves and others in the workplace.	(Dahl & Kongsvik, 2017)
Engagement And Involvement	It is an active form of employee participation and feedback from all levels of the organization. Employee engagement and involvement can be found in a decision-making process, OSH planning, and ideas contribution to improvement.	(Filho, et al., 2010)
Risk	It is a potential loss that can be caused when in contact with hazard or the failure of a function.	(Flin, et al., 2000)
Competence	Describe the ability of the employees at work based on their job description which concerns to safety aspects.	(Flin, et al., 2000)

Table 4.4 Safety Culture Factors Operational Definition (continuation)

Factors	Operational Definition	Reference
Information And Communication	Describe awareness, attention, and willingness to communicate information and issues related to OSH.	(Filho, et al., 2010)
Organizational Learning	A learning process that focuses on aspects of practice, reporting, culture, and learning from mistakes and failures.	(Filho, et al., 2010)

4.2.3 Maturity Level Guideline

The maturity level of safety culture consist of five level, namely from the lowest to highest, Pathological, Reactive, Bureaucratic/Calculative, Proactive, and Generative/Sustainable. These level are used as the guideline to determine the questionnaire options in every indicator. The options are the alternatives that should represent the real condition in the company for each level. Several reference of parameter are used as shown in the table below.

Table 4.5 Safety Culture Maturity Level Parameter Guideline for defining alternative on each level

4.2.4 1st Iteration: References and Resources Collection of Safety Culture Indicators

The first iteration is the collection of safety culture indicators from several sources and references (included in Table 4.6). The safety culture indicators is defined as the general characters of culture in an organisation. It is grouped into 8 factors and categorized based on the three aspects.

The amount of aspect and factors in the entire framework should be balanced. The distribution of aspects and factors in each indicatros as a result of the first iteration is shown in Table 4.6. There are a total of 87 indicators of safety culture maturity. There are 25 indicators categorized as psychological aspect, 38 indicators for behavioral aspect and the remaining 24 indicators are situational aspect. In each factors the average amount of indicators are 10 which are also balanced.

Table 4.6 Aspects and Factors distribution of the 1st Iteration

Factor	Number of Questions			Total
	Psychological Aspect	Behavioral Aspect	Situational Aspect	
Commitment	4	4	5	13
Leadership	3	6	1	10
Responsibility	2	6	0	8
Commitment	4	4	5	13
Engagement & Involvement	2	5	2	9
Risk	4	1	7	12
Competence	5	4	2	11
Information & Communication	4	4	5	13
Organizational Learning	1	8	2	11
TOTAL	25	38	24	**87**

The determination of item in each level is based on the parameter in Table 4.5. Part of the framework result in iteration 1 is shown in Table 4.7 while the complete table is presented in Appendix A.

Table 4.7 Framework Result of the first iteration (example)

Factor	Reference	ID	As-pect	Indicator	Level				
					Pathological	Reactive	Bureaucratic/Calculative	Proactive	Sustainable / Generative
Commitment ...	A.P.G. Filho et al. / Safety Science 48 (2010) 615–624	C-1	***Situational Aspect***	Audit program in work safety and environment	The organisation does not audit in safety at work	The organisation audits in safety at work only after serious accidents and work-related illnesses occur	The organisation has an auditing program in safety at work only in areas where risk of accident and work-related illness exist	The organisation has an auditing program in all the its sectors for safety at work	The organisation has an auditing program in all its sectors for both safety at work and environment
		C-2	***Situational Aspect***	The existence of OSH team in the company	The organisation does not have a team to give support in safety at work	The organisation has a small team to give support in safety at work	The organisation has a team that is big enough to give support in safety at work	The organisation has a team that is big enough to give support in safety at work	The organisation does not have a team to give support in safety at work specifically because the responsibility for it is shared by all the organisation members
	...	...	:	...	...	...	...	...	...
...	...	...	:	...	...	...	...	...	...

Table 4.7 Framework Result of the first iteration (example)- (continuation)

Factor	Reference	ID	As-pect	Indicator	Level				
					Pathological	Reactive	Bureaucratic/Calculative	Proactive	Sustainable / Generative
		...	⋮	..	...	...	...	...	...
Organisational Learning	Filho, et al. (2010)	OL-10	***Situational Aspect***	Conducting review of OSH Management System	The company does not conduct review to OSH Management System for improvement of work safety	The company does conduct review to OSH Management System for improvement of work safety when accident happened	The company does conduct review to OSH Management System for improvement of work safety to comply with the regulations	The company systematically and structured conduct review to OSH Management System for improvement of work safety	The company periodically conduct review to OSH Management System which is systemic and structured for improvement of work safety
		OL-11	***Behavioral Aspect***	The aim of analyzing unusual events	The analysis of unusual events aims to identify the guilty ones only	The analysis of unusual events aims to identify the cause of the events	The analysis of unusual events aims to identify the cause of the events and the guilty ones	The analysis of unusual events aims to identify the root cause of the events	The analysis of unusual events aims to identify the root cause of the events and give treatment to the guilty ones

4.2.5 2nd Iteration: Framework Development according to the Company

The second iteration is development and adjustment of previous resulted framework so that the indicators could be implemented in PT SMART. Focus Group Discussion (FGD) was conducted at the company to review and evaluate the framework. The discussion was participated by two of the safety expert from PT SMART and the researcher. It was conducted on May 25th.

The major adjustment as the result of discussion is the reduction of the measurement instruments (the indicators). It was firstly suggested to reduce into the number of 30 indicators to be measured. However, since there are 8 factors included in the measurement process, the final result of the framework consist of 35 instruments so that each factor could have at least 4 indicators to be measured. There are several consideration during the framework adjustment and selection. Those consideration are as follow:

1. *Time Limitation*

   In order to retain the respondent interest in participating the assessment, the shorter time frame required the better. Worthington & Whittaker (2006) recommend making a measurement instrument that takes no more than 15 to 20 minutes to manage. The result from the discussion claimed that employees at the company would only have spare time for approximately 30 minutes to be respondents. The fewer the better.

   Time length for respondents to fill up the questionnaire is depending on number of constructs / variables and the total questions to be responded, number points of rating scales, clarity of language used in the questionnaire, respondents' background etc. (Fung, 2015).

2. *Avoiding Survey Fatigue*

   Keeping a survey questions count low is crucial, because survey fatigue is a real danger for survey makers which hopes to collect the best, most accurate data (Milikin, 2016). A few well worded, well designed survey questions are usually no problem for respondents to complete. But, once a survey starts to drive respondents into long question with page after page of

hard and complicated options phrasing, respondents both lose interest and become too frustrated to complete the rest of the survey.

Essentially this happens when surveys are too long and include questions that aren't applicable to the respondent. They get sick of trying to figure out what they should answer and what they can skip. (Fryrear, 2016). This constraint is also related to the time limitation constraint. The longer it takes time the more possibility of respondent to experience fatigue.

3. The Type of Questionnaire

The complexity of the Safety Culture questionnaire could not be said in a low level. Even though the questions are multiple choice, but the options are not simple scaling answer. There are five statement that explain each of the maturity level parameter, and the options were randomized. Respondent have to read carefully and thoroughly.

The wording of the instruments, including questions and options were also need to be considered. Usage of clear words and simple language and avoid ambiguous concept to ensure the equal perception from the respondents.

4. The Type of Respondent

This include the competence, ability and experience of the respondent. The educational background is highly affecting the competence. The officers or staff in the company are mostly high school graduate, while several of the employee are junior high graduate. Only few of them who have got the bachelor degree, including the section head and several foreman and officer. These constraints give an image in developing the questionnaire design and determining the amount of questions.

5. Concise Questionnaire Design

This constraints help in determining the selection process of the indicators. On each of the indicator, keywords were generated. Then an indicator which could represents another indicators were selected based on the keywords generated. It was also possible to choose a single indicator (not a representative) and to not choose general indicator.

6. *The Objectivity and Accuracy of the Assessment Process*

This constraint is highly related with time spent, respondent's competence and the questionnaire design itself. The more questions are asked and more time spent, the more accurate the answer should be, however there is time limitation. When respondent lose interest then the accuracy and objectivity would be dropped dramatically.

People can answer questions about their gender and age easily, but when it comes to measuring attitudes and opinions, many people have trouble formulating an answer (Mora, 2016). Then since the type of the questionnaire could not be answered clearly and require a careful thinking, the questions should be limited in accordance with the time limitation.

7. *Compatibility with the Company Condition*

The selection process in the 2nd iteration also consider the compatibility of the indicators and questionnaire instruments with the current condition of the company. It is also related with designing a concise questionnaire which should only measure what are really needed considering the other limiting constraints.

Above all of the consideration, a simulation test was conducted to determine the average time to answer the questionnaire. Considering the long word in each options, every question needs around half until a minute to answer depends on the item complexity. In total, it is approximately 30 minutes needed to finish the whole questionnaire including the respondent personal data.

The final result was 35 indicators were chosen as the measurement instrument in Commercial Department. The aspects of safety culture is also be the consideration in selecting the indicators. The distribution of psychological, behavioral, and situational aspects should be balanced.

After the selection were made, in this phase the adjustment process was also made to have several terms and definition been rearranged according to the terms used in the company. These changes include:

1. The change from the word supervisor to Section Head.

2. The change from the word Company Management to Commercial Department (for several specific cases).
3. The change from the word work area to Commercial Department area.
4. The word work unit is defined as the work area at the section area, no change has been made.

Data recapitulation of aspect and factor distribution in the result of second iteration is presented in Table 4.8. The chosen indicators which would be the safety culture maturity framework from second iteration is shown in Table 4.9.

Table 4.8 Aspects and Factors distribution of the 2nd Iteration result

Factor	Number of Questions			Total
	Psychological Aspect	Behavioral Aspect	Situational Aspect	
Commitment	2	1	2	5
Leadership	1	2	1	4
Responsibility	1	3	0	4
Engagement & Involvement	2	1	1	4
Risk	1	1	3	5
Competence	2	0	2	4
Information & Communication	2	0	2	4
Organizational Learning	0	4	1	5
TOTAL	11	12	12	**35**

Table 4.9 Framework result of the 2nd Iteration (the indicators selection and adjustment)

Factor	Reference	ID	Aspect	Keywords	Indicator
Commitment	Filho, et al. (2010)	C-6	*Behavioral Aspect*	Management commitment to work in safety (C-5)	Commitment of Management in performing the work safety procedures
		C-7	*Situational Aspect*	OSH policy and regulations establishment (C-1,2,4,5,9)	OSH policy establishment in form of reward and punishment system

Table 4.9 Framework result of the 2nd Iteration (the indicators selection and adjustment) – (continuation)

Commitment	Filho, et al. (2010)	C-8	*Situational Aspect*	Consider safety aspects in every activity (C-13)	Safety aspects consideration while cooperating with outsourcing parties
	Dahl & Kongsvik, (2017)	C-10	*Psychological Aspect*	Company encouragement to work in safety	Company encouragement to work according to safety rules
		C-11	*Psychological Aspect*	Commitment to comply to safety aspects (C-12)	Commitment to ensure all types of jobs at the work area (operation and maintenance) comply the safety aspect
Leadership	Lingard, et al. (2014)	L-1	*Behavioral Aspect*	Supervising to work in safety from the management, safety as the priority (L-2,5)	Supervisors inspection of safety to their work unit
	Fleishman (1950)	L-3	*Behavioral Aspect*	Management ensure and inspect according to safety standard (L-5,6,9)	Ensure the work equipment meet the safety standard
	Dahl & Kongsvik, (2017)	L-7	*Psychological Aspect*	Supervisor encouragement to work in safety (L-4)	Supervisor encouragement to work in safety
	PJB Based Practice	L-10	*Situational Aspect*	Speeches encouragement to employee (L-8)	Supervisor speeches concerning OSH
Responsibility	NOSACQ-50	R-2	*Psychological Aspect*	Responsibility to maintain and care to safety at work environment (including co-workers) (R-1,3,6)	Employee response to unsafe actions of his co-workers
	Dahl & Kongsvik, (2017)	R-4	*Behavioral Aspect*	Responsibility to report hazards	Employees reporting to near miss incident, and hazards potential
	PJB Based Practice	R-7	*Behavioral Aspect*	Supervisor responsibility to employees safety (R-5)	Supervisors monitor during the overtime and holiday

Table 4.9 Framework result of the 2nd Iteration (the indicators selection and adjustment) – (continuation)

Responsibility	PJB Based Practice	R-8	***Behavioral Aspect***	OSH workers as role model of model	OSH workforce performance in taking the OSH role
Engagement and Involvement	NOSACQ-50	EI-3	***Psychological Aspect***	Emloyee contribution to safety (EI-2,7,9)	Employee contribution to work safety environment
	NOSACQ-50 ; Lingard, (2014)	EI-4	***Psychological Aspect***	Freedom to talk about safety (open communication) (EI-1)	Open communication system concerning unsafe action and condition
	Dahl & Kongsvik (2017)	EI-5	***Behavioral Aspect***	Open response to opinion	Response to discussion concerning OSH aspects
	PJB Based Practice	EI-6	***Situational Aspect***	Employee involvement posibility (EI-8)	Employeed participation in OSH coaching
Risk	Flin et al. (2000) ; SAFE Work Minitoba (2015) ; Runmo (1994)	RI-1	***Situational Aspect***	Preventive actions of safety tools procurement	Availability of safety tools and sign
	NOSACQ-50	RI-3	***Psychological Aspect***	Risk control at the company (RI-2,4,6,7,8)	Effectiveness of safety patrol to control risk and hazard findings
	PJB Based Practice	RI-9	***Situational Aspect***	Preventive actions of work equipments (RI-5,10)	Cleanliness of the work equipments
		RI-11	***Situational Aspect***	Preventive actions of communication system	Shift hand over information system

Table 4.9 Framework result of the 2nd Iteration (the indicators selection and adjustment) – (continuation)

Risk	Flin et al. (2000) ; SAFE Work Minitoba (2015)	RI-12	***Behavioral Aspect***	Preventive actions of high risk hazards	Company's act due to smoking violations
Competence	Flin et al. (2000) ; SAFE Work Minitoba (2015)	CO-2	***Situational Aspect***	Job Description, Job Requirement (CO-1,3,4,7)	Clearness of job description (responsibility, task, position, competence required)
	NOSACQ-50	CO-5	***Situational Aspect***	Support Job Requirement (Increase competence) (CO-8,10,11)	Continuous Education to improve competence for risk control
		CO-6	***Psychological Aspect***	Cause of accident analysis related to subject (CO-1)	The focus on cause of accidents analysis
	Dahl & Kongsvik (2017)	CO-9	***Psychological Aspect***	Training for certain jobs (CO-10,11)	Training compatibility related to work typical
Information and Communication	NLR/ Netherland Aeroscope Centre (2016)	IC-4	***Psychological Aspect***	Discussion related to safety (effective communication) (IC-10,13)	Safety issues discussion in the work environment
	NLR/ Netherland Aeroscope Centre (2016) ; Zaira & Hadikusumo (2017)	IC-5	***Situational Aspect***	Information Media (IC-9)	The information (billboards, posters, videos, bulletins, etc.) about the near miss incident (safety issues) to enhance the employees awareness
	Lingard et al. (2014); Filho et al. (2010)	IC-7	***Psychological Aspect***	Communication system (freedom) (IC-1,2,3,6,9,12)	Freedom to express the unsafe action and condition anytime without communication forum
	PJB Based Practice	IC-11	***Situational Aspect***	Information regarding work (IC-8)	Clear and understandable work instructions and placed at the strategic locations

Table 4.9 Framework result of the 2nd Iteration (the indicators selection and adjustment) – (continuation)

Organisation Learning	Lingard et al. (2014)	OL-3	***Behavioral Aspect***	Openness and Responsiveness to give feedback	Company openness and responsiveness in following up unsafe condition and action report
		OL-5	***Behavioral Aspect***	Knowledge sharing (Focus on OSH-related issues) (OL-1,2)	Sharing knowledge, experience and discussion among stakeholders concerning OSH to ensure its implementation in the company
	PJB Based Practice	OL-6	***Behavioral Aspect***	Knowledge sharing (Focus on near miss incident) (OL-1,2,8)	Sharing knowledge, experiences and discussion among stakeholders concerning near miss incident in all work unit
	Filho, et al. (2010)	OL-7	***Behavioral Aspect***	Analysis as preventive actions (OL-9,11)	Company intensity to analyze the cause of near miss incident
		OL-10	***Situational Aspect***	Performance measurement as a system (OL-4)	Conducting review of OSH Management System

4.2.6 3rd Iteration: Framework Verification and Questionnaire Development

The third iteration was the conversion from framework into a formal questionnaire. Not only that, it was required to be done in order to review and do the verification of the questionnaire. The questionnaire review and evaluation was conducted in form of discussion with one of the section head (GBJ Section Head) in commercial department. The result of the discussion are as follow:

1. Simplified options wording (shorter but clear), but still carrying the same meaning from the original data of indicators.
2. The number of questions were also limited considering the type of employee on each section. However 35 items were still acceptable.
3. The options are randomized to maintain the objectivity. However the differences between options should be clear.
4. Use of simple and communicative language. It is avoided to recall the phrase which have already stated in the questions in the options wording.

Table 4.10 Iteration 3 Framework result

Factor	Reference	ID	Aspect	Level				
				Pathological	Reactive	Bureaucratic/ Calculative	Proactive	Generative/Sustainable
Commitment	Filho, et al. (2010)	C-6	***Behavioral Aspect***	Management do not implement any work safety procedure at all.	Only implement work safety procedure after accident.	Implement work safety procedures as compliance to OSH regulations.	Implement work safety procedures due to awareness.	Implement work safety procedures and periodically evaluated.
		C-7	***Situational Aspect***	Company do not apply any OSH policy.	Set OSH policy and implement punishment sistem after accident	Set OSH policy and implement reward and punishment system to high risk work areas.	Set OSH policy and implement reward and punishment system at all of the unit area.	Set OSH policy yet do not need reward and punishment system due to motivated employees in all unit area.
		C-8	***Situational Aspect***	Company choose outsource company based on the low price.	Company consider OSH aspects when an accident related to outsource company is occured.	Establish policy in the outsource pre-qualification process before signing contract with outsource.	Esablish policy in the pre-qualification process before signing contract with outsource company and check their job systematically.	Consider outsource company as a part of work safety system with high awareness on the work safety.
	Dahl & Kongsvik, (2017)	C-10	***Psychological Aspect***	Company has not encourage their employees to work according to the OSH rules	Encourage their employees to work according to OSH rules after an accident is occured.	Encourage their employees to work according to OSH rules as a compliance to the OSH policy.	Company encourage their employees to work according to the rules of OSH as a compliance to the OSH policy with the aim to minimize work accident.	Company encourage their employees to work according to the rules of OSH as a compliance to the OSH policy even though in the urgent/emergency work.
		C-11	***Psychological Aspect***	Company do not have commitment yet to ensure all of the work fulfill safety aspect.	Company ensure all of the work fulfill safety aspect after an accident is occured.	Company have commitment to ensure all of the work fulfill safety aspect.	Company have high commitment to ensure all of the work fulfill safety aspect without any exception.	Company have commitment and supported by personal awareness from the employees to ensure all of the work fulfill safety aspect

Table 4.10 Iteration 3 Framework result (continuation)

Factor	Reference	ID	Aspect	Level				
				Pathological	Reactive	Bureaucratic/ Calculative	Proactive	Generative/Sustainable
Organisation Learning	Filho, et al. (2010)	OL-7	***Behavioral Aspect***	The company does not analyze near miss incident that happened	The company does analyze near miss incident when accident happened	The company does analyze near miss incident only in the work area with high accident risk	The company does analyze near miss incident only in the work area with high and medium accident risk	The company analyze all near miss incident in the entire work area as the preventive actions
		OL-10	***Situational Aspect***	The company does not conduct review to OSH Management System for improvement of work safety	OSH Management System is reviewed for improvement of work safety when accident happened	OSH Management System is reviewed for improvement of work safety to comply with the regulations	OSH Management System is reviewed systematically for improvement of work safety	OSH Management System is reviewed systematically and periodically for improvement of work safety

In this phase, the questions construction was also conducted as part of the questionnaire development. The complete result of the third iteration is shown in Table 4.10. The result of the final questionnaire based on third iteration result which is used as the measurement instrument in Commercial Department of PT SMART is presented in Appendix E. While the distribution of the questions and the arrangement of the options is shown in Table 4.11. Table 4.12 shows the answer value of each option representing maturity level.

Table 4.11 Questions Distributions and Options Arrangement of the final Questionnaire

Factor	ID	Question Number	Options Arrangement
Commitment	C6	**5**	1-2-3-4-5
	C7	**1**	1-2-3-4-5
	C8	**2**	5-4-3-2-1
	C10	**3**	1-2-3-4-5
	C11	**4**	5-4-3-2-1
Leadership	L1	**6**	1-2-3-4-5
	L3	**7**	1-5-2-4-3
	L7	**8**	1-2-3-4-5
	L10	**9**	1-2-3-4-5
Responsibility	R2	**10**	1-5-2-4-3
	R4	**13**	1-2-3-4-5
	R7	**11**	1-2-3-4-5
	R8	**12**	5-4-3-2-1
Engagement & Involvement	EI3	**14**	1-2-3-4-5
	EI4	**15**	5-4-3-2-1
	EI5	**17**	1-2-3-4-5
	EI6	**16**	1-2-3-4-5
Risk	R1	**18**	1-2-3-4-5
	R3	**22**	1-2-3-4-5
	R9	**19**	1-5-2-4-3
	R11	**20**	1-2-3-4-5
	R12	**21**	5-4-3-2-1
Competence	CO2	**23**	5-4-3-2-1
	CO5	**24**	5-4-3-2-1
	CO6	**25**	1-5-2-4-3
	CO9	**26**	1-5-2-4-3

Table 4.11 Questions Distributions and Options Arrangement of the final Questionnaire (continuation)

Factor	ID	Question Number	Options Arrangement
Information & Communication	IC4	**27**	1-2-3-4-5
	IC5	**28**	5-4-3-2-1
	IC7	**29**	1-2-3-4-5
	IC11	**30**	5-4-3-2-1
Organizational Learning	OL3	**31**	1-5-2-4-3
	OL5	**32**	5-4-3-2-1
	OL6	**33**	1-5-2-4-3
	OL7	**34**	1-2-3-4-5
	OL10	**35**	1-2-3-4-5

Table 4.12 The Score in each Level of Maturity

Level	Pathological	Reactive	Bureaucratic/ Calculative	Proactive	Generative/ Sustainable
Score	1	2	3	4	5

4.3 Assessment Result and Test

This subchapters discusses about the assessment process and its result. There several step in the assessment process of safety culture maturity level. Those are the aspect weighting, data adequacy test, validity test, and reliability test and data recapitulation.

4.3.1 Safety Culture Aspects Weighting

The three aspects of safety culture are treated equally, so that each of them should have its own portion. The aspects weighting in this research used the AHP (Analytical Hierarchy Process) method which require the expert judgement. The software used to calculate the weight distribution is *Expert Choice.*

Three people, the expert in OSH field of PT SMART, participated in determining the aspect weight. Questionnaire method was used to compare the importance level between the aspects. The questionnaire used is presented in Appendix B. The result of the aspects comparison are shown in Figure 4.3-4.5.

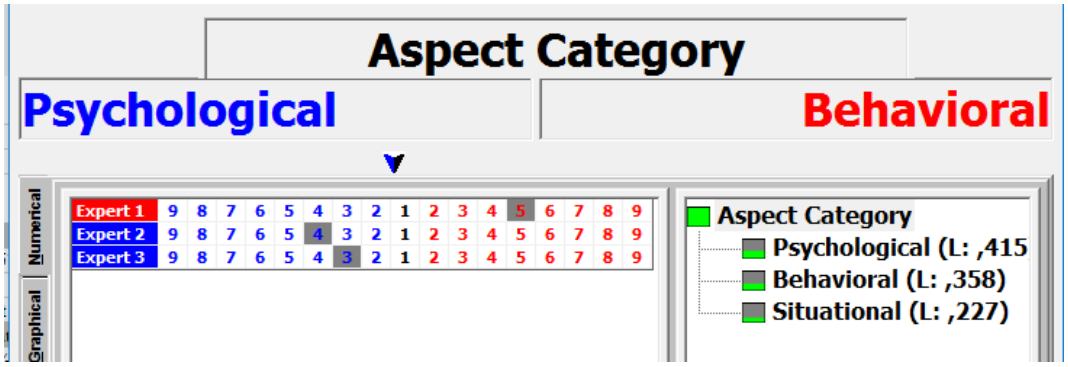

Figure 4.3 The result of importance level comparison between Psychological aspect and Behavioral aspect

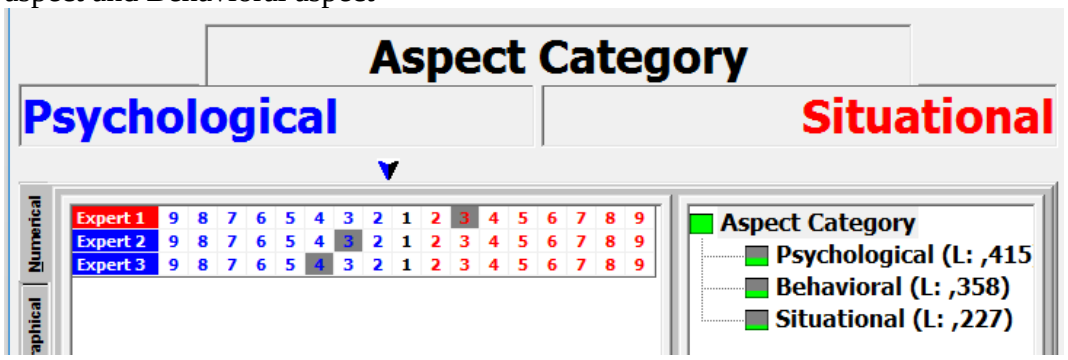

Figure 4.4 The result of importance level comparison between Psychological aspect and Situational aspect

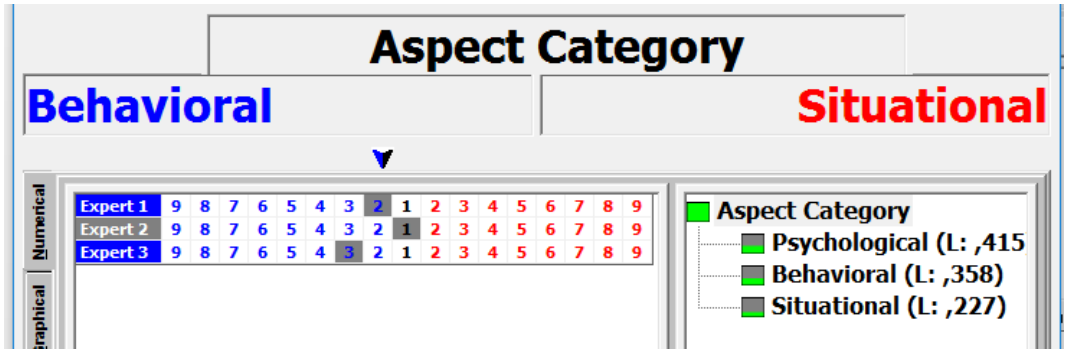

Figure 4.5 The result of importance level comparison between Behavioral aspect and Situational aspect

The result of the Expert Choice software for each participant are shown in Figure 4.6-4.8. The combination of three expert judgement gave the result of the safety culture aspect weighting as shown in Figure 4.9.

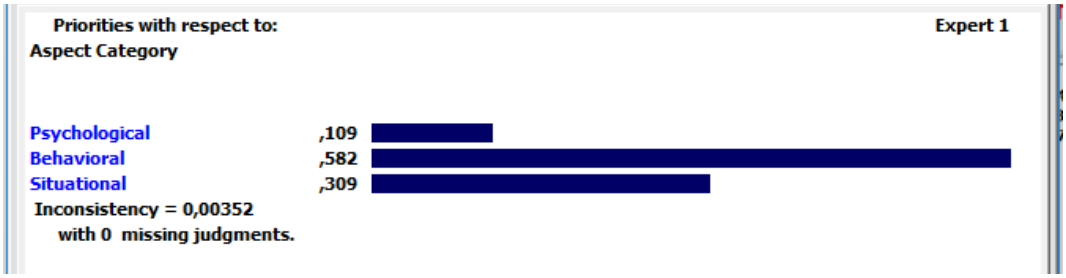

Figure 4.6 Aspect weighting result from Expert 1

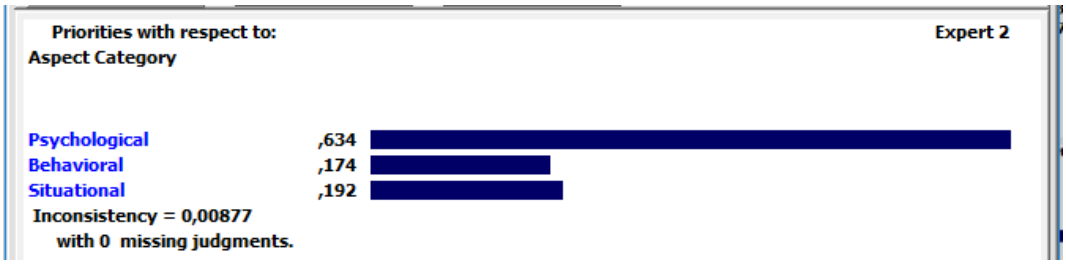

Figure 4.7 Aspect weighting result from Expert 2

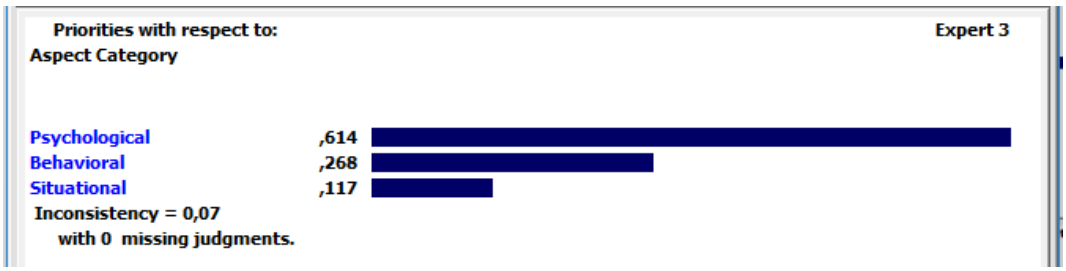

Figure 4.8 Aspect weighting result from Expert 3

Figure 4.9 Aspect weight final result (combined)

Table 4.13 presents the recapitulation of the aspects weighting using Expert Choice software.

Table 4.13 Aspect Weighting Result

Since the inconsistency of each weighting process is less than 0,1 then the data are acceptable and can be proceeded to the next step.

4.3.2 Data Collection and Data Adequacy Test

The assessment of safety culture maturity level is done in two process of iteration.

4.3.2.1 Iteration 1

In the first iteration data was collected from 70 respondents out of 182 people from a population. There are 6 section of Commercial Department which was going to be assessed. Stratified random sampling method is used based on the section grouping. Proportionate stratification approach was used in this research. The sample size of each section is proportionate to the population size of the section. The sample size of each section were determined by the following proportion formula:

$$n_i = (N_i / N) * n$$

n_i is the sample size of section *i*, N_i is the population size of of *i*, N is the total population size (182), and n is the total sample size which has already determined (70). The section sample size calculation result is shown in Table 4.14.

Table 4.14 Section sample size calculation result

Section	Population (N_i)	Sample (n)	Proportion (N_i / N)
GBJ	83	32	46%
Packaging	36	14	20%
Bulk Filling	19	7	10%
Tank Farm	18	7	10%
Terminal CPO	11	4	6%
Weighbridge	15	6	8%
Total	182	70	1

The result of the first iteration should be tested using data adequacy test. The test is used to determine whether the sample of data collected have fulfilled the required data sample size (N') based on the calculation, so that it can represent the population which was being tested. If the current number of data samples (N) is fewer than the required sample size (N'), it means that the data sample does not fulfill the requirement and does not represent the population. In that case, it would be needed to collect more data to meet the required value of N'. Data adequacy test can be done by calculating the value of N' using the following formula:

$$N' = \left[\frac{Z.S}{\overline{X}.k} \right]^2$$ (Wignjosoebroto, 1995)

Where:

N' : the required sample size

Z : *Index* of confidence level (confidence level 95% ≈ *index* 1,96)

S : standard deviation sample

$\bar{x}$: sample mean

k : margin of error (5%)

Data adequacy test was done for each item in the questionnaire. The calculation result of data adequacy test is presented in Table 4.15.

Table 4.15 Data adequacy test calculation result of Iteration 1

Question Number	Mean	Std Dev	N'	Conclusion
Item 1	4,086	0,697	44,673	SUFFICIENT
Item 2	4,100	1,024	95,784	INSUFFICIENT
Item 3	4,143	0,921	75,999	INSUFFICIENT
Item 4	4,229	0,726	45,264	SUFFICIENT
Item 5	4,529	0,675	34,145	SUFFICIENT
Item 6	4,257	1,003	85,245	INSUFFICIENT
Item 7	4,257	0,879	65,584	SUFFICIENT
Item 8	4,100	0,995	90,485	INSUFFICIENT
Item 9	3,986	1,000	96,710	INSUFFICIENT
Item 10	3,986	1,000	96,710	INSUFFICIENT
Item 11	4,171	0,992	86,956	INSUFFICIENT
Item 12	4,100	0,965	85,186	INSUFFICIENT
Item 13	3,886	0,971	95,999	INSUFFICIENT

Question Number	Mean	Std Dev	N'	Conclusion
Item 14	4,286	1,009	85,220	INSUFFICIENT
Item 15	4,329	1,073	94,425	INSUFFICIENT
Item 16	4,229	1,024	90,101	INSUFFICIENT
Item 17	4,486	0,812	50,343	SUFFICIENT
Item 18	4,186	1,054	97,349	INSUFFICIENT
Item 19	3,800	0,957	97,470	INSUFFICIENT
Item 20	4,114	1,043	98,785	INSUFFICIENT
Item 21	3,871	0,977	97,834	INSUFFICIENT
Item 22	3,900	0,980	97,075	INSUFFICIENT
Item 23	3,757	0,939	96,033	INSUFFICIENT
Item 24	4,300	1,040	89,972	INSUFFICIENT
Item 25	3,771	0,951	97,611	INSUFFICIENT
Item 26	3,971	0,947	87,462	INSUFFICIENT
Item 27	4,114	1,029	96,154	INSUFFICIENT
Item 28	4,029	1,007	95,976	INSUFFICIENT
Item 29	3,857	0,967	96,657	INSUFFICIENT
Item 30	4,414	0,940	69,700	SUFFICIENT
Item 31	4,271	1,034	90,133	INSUFFICIENT
Item 32	4,014	1,014	98,102	INSUFFICIENT
Item 33	4,000	1,007	97,432	INSUFFICIENT
Item 34	4,229	1,066	97,574	INSUFFICIENT
Item 35	4,029	1,021	98,721	INSUFFICIENT
		N' Mean		86,253
		N' Max		98,785
		Total Insufficient Data		29
		Conclusion		INSUFFICIENT

The result of the test mostly shown that the data collected is insufficient. The average sample size needed for all item is 86 and the maximum value of sample size needed is 98. Since the data is not sufficient, more data should be collected with the minimum amount of 28 respondents.

4.3.2.2 Iteration 2

In Iteration 2, more data would be collected. It was decided to collect a total of 100 data, so that 30 data was needed. Using the same method used in Iteration 1 of data collection, the calculation result of section sample size is shown in Table 4.16.

Table 4.16 Calculation result of sample size in each section

Section	Population (N_i)	Sample (n)	Proportion (N_i / N)	Additional
GBJ	83	46	46%	14
Packaging	36	20	20%	6
Bulk Filling	19	10	10%	3
Tank Farm	18	10	10%	3
Terminal CPO	11	6	6%	2
Weighbridge	15	8	8%	2
Total	182	100	1	30

Using the same method of data adequacy test in the first iteration, the adequacy test calculation result of the second iteration is shown in 4.17.

Table 4.17 Data adequacy test calculation result of Iteration 2

Question Number	Mean	Std Dev	N'	Conclusion
Item 1	0,739	4,140	48,939	SUFFICIENT
Item 2	1,014	4,110	93,532	SUFFICIENT
Item 3	1,027	4,070	97,928	SUFFICIENT
Item 4	0,682	4,200	40,476	SUFFICIENT
Item 5	0,674	4,520	34,158	SUFFICIENT
Item 6	0,998	4,120	90,125	SUFFICIENT
Item 7	0,994	4,110	89,856	SUFFICIENT
Item 8	1,015	4,020	97,930	SUFFICIENT

Table 4.17 Data adequacy test calculation result of Iteration 2 (continuation)

Question Number	Mean	Std Dev	N'	Conclusion
Item 9	0,958	3,970	89,530	SUFFICIENT
Item 10	1,002	4,080	92,646	SUFFICIENT
Item 11	0,940	4,310	73,020	SUFFICIENT
Item 12	0,917	4,220	72,481	SUFFICIENT
Item 13	0,967	4,070	86,684	SUFFICIENT
Item 14	1,042	4,190	94,945	SUFFICIENT
Item 15	0,989	4,350	79,361	SUFFICIENT
Item 16	1,001	4,260	84,880	SUFFICIENT
Item 17	0,857	4,440	57,194	SUFFICIENT
Item 18	0,981	4,260	81,459	SUFFICIENT
Item 19	0,963	3,890	94,153	SUFFICIENT

Question Number	Mean	Std Dev	N'	Conclusion
Item 20	1,028	4,120	95,611	SUFFICIENT
Item 21	0,968	4,050	87,769	SUFFICIENT
Item 22	0,948	3,990	86,763	SUFFICIENT
Item 23	0,943	3,800	94,592	SUFFICIENT
Item 24	0,999	4,350	81,002	SUFFICIENT
Item 25	0,918	3,840	87,831	SUFFICIENT
Item 26	0,981	3,870	98,776	SUFFICIENT
Item 27	0,975	4,170	84,004	SUFFICIENT
Item 28	0,974	4,020	90,246	SUFFICIENT
Item 29	0,957	3,850	95,030	SUFFICIENT
Item 30	0,903	4,350	66,237	SUFFICIENT
Item 31	1,072	4,270	96,801	SUFFICIENT
Item 32	0,983	4,060	90,058	SUFFICIENT
Item 33	0,998	4,120	90,125	SUFFICIENT
Item 34	1,022	4,190	91,409	SUFFICIENT
Item 35	0,974	4,200	82,712	SUFFICIENT
		N' Mean		83,379
		N' Max		98,776
		Total Insufficient Data		0
		Conclusion		SUFFICIENT

The result of Iteration 2 are sufficient for all item in the questionnaire since the required sample size have already met. 100 out of the minimum 98 respondent have already participated in the assessment process.

4.3.3 Data Recapitulation and Maturity Level Result

The complete data recapitulation is presented in Appendix C. Data recapitulation of item mean is shown in Table 4.18. The items are ranked based from the value of TFN 2 (kernel) from the smallest to largest value.

Table 4.18 Data Recapitulation of Items' TFN

Item	TFN 1	TFN 2	TFN 3	Rank	Item	TFN 1	TFN 2	TFN 3	Rank
Item 1	3,15	4,14	4,84	20	Item 21	3,06	4,05	4,62	10
Item 2	3,12	4,11	4,6	15	Item 22	2,99	3,99	4,6	7
Item 3	3,09	4,07	4,62	12	Item 23	2,82	3,8	4,56	1
Item 4	3,2	4,2	4,88	24	Item 24	3,38	4,35	4,74	32
Item 5	3,52	4,52	4,92	35	Item 25	2,85	3,84	4,54	2

Item 6	3,15	4,12	4,68	17	Item 26	2,87	3,87	4,52	4
Item 7	3,13	4,11	4,65	16	Item 27	3,19	4,17	4,7	21
Item 8	3,04	4,02	4,58	9	Item 28	3,04	4,02	4,64	8
Item 9	2,98	3,97	4,6	6	Item 29	2,86	3,85	4,51	3
Item 10	3,09	4,08	4,62	14	Item 30	3,37	4,35	4,78	33
Item 11	3,33	4,31	4,73	30	Item 31	3,29	4,27	4,68	29
Item 12	3,24	4,22	4,73	26	Item 32	3,07	4,06	4,61	11
Item 13	3,08	4,07	4,66	13	Item 33	3,12	4,12	4,64	19
Item 14	3,2	4,19	4,65	22	Item 34	3,2	4,19	4,65	23
Item 15	3,36	4,35	4,74	31	Item 35	3,2	4,2	4,68	25
Item 16	3,29	4,26	4,73	27					
Item 17	3,45	4,44	4,8	34					
Item 18	3,29	4,26	4,73	28					
Item 19	2,9	3,89	4,56	5					
Item 20	3,14	4,12	4,66	18					

The desire to develop a computable model based upon judgements made by various individuals expressed within an ordinal/interval scale leads to the consideration of some well-developed principles of fuzzy sets and arithmetic (Hassall, 1999). Lewis (1997) stated that there are two reason of taking values on subset of numeric data, first because there are typically some practical upper and lower limits beyond which it is inconceivable that the variable would range, and second because ordinarily the variable cannot be measured beyond a certain degree of precision.

The most commonly used membership function is the evenly-spaced triangular function which allows for simple computation to transform input variables into fuzzy variables (Li, 2013). The Triangular Fuzzy Number (TFN) method is used to determine the range value of maturity level. This research use five level of scale in the options. Using this interpretation, a respondent who judges 3 to be the appropriate score makes a constrained choice in the range where 2 is the minimum value and 4 the maximum. According to Hassall (1999) in the method of extracting fuzzy scores the score 3 corresponds to a triangular fuzzy number (2, 3, 4). Similarly, score 4 corresponds to (3, 4, 5), and so on. The full scoring correspondence is taken to be as follows.

Score 1 = TFN (1,1,2)

Score 2 = TFN (1,2,3)

Score 3 = TFN (2,3,4)

Score 4 = TFN (3,4,5)

Score 5 = TFN (4,5,5)

Table 4.19 shows the frequencies of the score appearances in each aspect of safety culture as well as the calculation result. Taking the average weighted score for each TFN representing the appropriate score when carried out with appropriate attention to arithmetic rules for TFNs thus, the written formula with example of calculation for psychological aspect is as follow.

$$Aspect\ (TFN\ 1, TFN\ 2, TFN\ 3) = \frac{\begin{pmatrix}(1,1,2) * (Freq\ 1) + (1,2,3) * (Freq\ 2) + (2,3,4) * (Freq\ 3) \\ +(3,4,5) * (Freq\ 4) + (4,5,5) * (Freq\ 5)\end{pmatrix}}{Total\ Frequencies}$$

$$Psychological\ (TFN\ 1, TFN\ 2, TFN\ 3) = \frac{\big((1,1,2) * 11 + (1,2,3) * 51 + (2,3,4) * 269 + (3,4,5) * 302 + (4,5,5) * 467\big)}{1100}$$

$$= (3.067, 4.057, 4.633)$$

Table 4.19 TFN Calculation of Aspect Value

Table 4.20 shows the final result of TFN value of Safety Maturity Level. The formula used is based on the equation (3.5)-(3-7) on each TFN value. It should be noted that, in this formulation, the TFN 2 value (kernel value) is identical to the weighted average (or mean) score recorded.

Table 4.20 Safety Culture Maturity Level of Commercial Department calculation result

	Psychological	***Behavioral***	***Situational***	Maturity Level	Differences
TFN 1	3,067	3,220	3,140	3,138	0,987
TFN 2	4,057	4,207	4,123	4,126	0,000

TFN 3	4,633	4,698	4,677	4,666	0,540
Weight	41,5%	35,8%	22,7%		

To determine whether the result of the maturity level falls to the upper or lower level, fuzzy triangular numbers interpretation method is used based on the Hassall's research about Methods of Analyzing Ordinal/Interval Questionnaire Data Using Fuzzy Mathematical Principles. The implementation of this scheme means that a transformation is possible for any triangular fuzzy number in terms of its kernel, minimum and maximum values. In effect a linguistic interpretation of the possibility space of the score which is intended to convey a meaningful commentary on the score result.

The Figure 4.10 illustrate the TFN of department maturity level which consist of triplet number. The main value is represented by the range of 4 to 4.126 while minimum value is in the range of 3.138 to 4 and maximum value from the value of 4.126 to 4.666. The interval could be interpreted as how close the extreme range to kernel value. The closer to the main value the more tendencies of these point contributing in the overall maturity level.

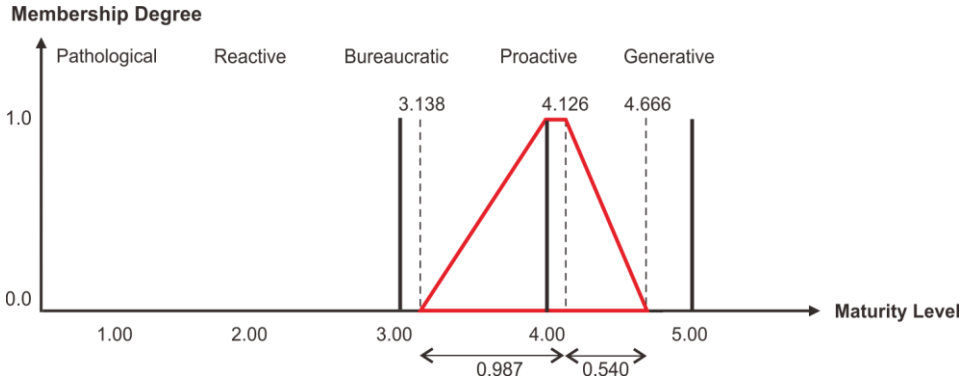

Figure 4.10 Triangular Fuzzy Number of Department Maturity Level

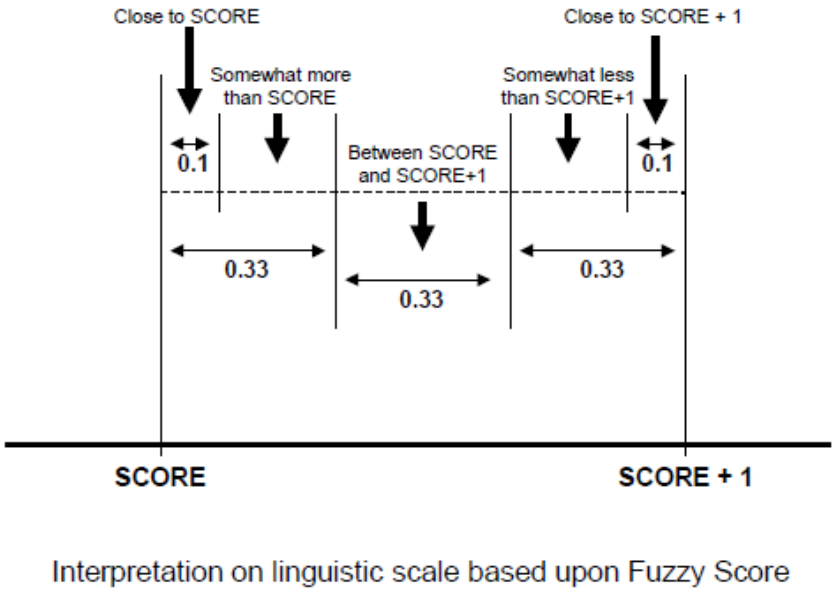

Figure 4.11 Fuzzy Triangular Interpretation Diagram

Referring to Figure 4.11 the interval between SCORE and SCORE + 1 is divided into a total of 5 regions each of which is associated with an appropriate linguistic modifier. Thus, as the calculated score moved from SCORE to SCORE + 1 it travels through successive regions in which a particular linguistic modifier applies (Hassall, 1999). Thus, initially it lies in the region *close to SCORE*, moving next to the region *somewhat more than SCORE*, then to a region *between SCORE and SCORE + 1*, then *somewhat less than SCORE + 1* and finally it lies *close to SCORE + 1*.

4.3.4 Validity Test of the Questionnaire

Rosenthal & Westen (2003) stated that validity test is performed to estimate the extent to which variance in the measure reflects the variance in the underlying construct. The measurement for validity testing is done by using bivariate correlation in SPSS software, looking at the correlation between each questionnaire instruments with the total score result. The result would be called significant when the calculated parameter r is higher than the critical r, which means that the item has significant effect to the total score. The validity test result of Safety Culture Maturity Level questionnaire for all participants could be seen in 4.21, with

significant items marked using two stars (**) at significance level of 0.01 (refer to appendix D for full r table).

Table 4.21 Pearson's Correlation Validity Test Result

		Total_Score
Item_1	Pearson Correlation	,297**
	Sig. (2-tailed)	,003
	N	100
Item_2	Pearson Correlation	,371**
	Sig. (2-tailed)	,000
	N	100
Item_3	Pearson Correlation	,474**
	Sig. (2-tailed)	,000
	N	100
Item_4	Pearson Correlation	,394**
	Sig. (2-tailed)	,000
	N	100
Item_5	Pearson Correlation	,246*
	Sig. (2-tailed)	,013
	N	100
Item_6	Pearson Correlation	,379**
	Sig. (2-tailed)	,000
	N	100
Item_7	Pearson Correlation	,310**
	Sig. (2-tailed)	,002
	N	100
Item_8	Pearson Correlation	,318**
	Sig. (2-tailed)	,001
	N	100
Item_9	Pearson Correlation	,535**
	Sig. (2-tailed)	,000
	N	100
Item_10	Pearson Correlation	,494**
	Sig. (2-tailed)	,000
	N	100
Item_11	Pearson Correlation	,483**
	Sig. (2-tailed)	,000
	N	100
Item_12	Pearson Correlation	,569**
	Sig. (2-tailed)	,000
	N	100
Item_13	Pearson Correlation	,340**
	Sig. (2-tailed)	,001
	N	100

		Total_Score
Item_19	Pearson Correlation	,295**
	Sig. (2-tailed)	,003
	N	100
Item_20	Pearson Correlation	,549**
	Sig. (2-tailed)	,000
	N	100
Item_21	Pearson Correlation	,513**
	Sig. (2-tailed)	,000
	N	100
Item_22	Pearson Correlation	,512**
	Sig. (2-tailed)	,000
	N	100
Item_23	Pearson Correlation	,410**
	Sig. (2-tailed)	,000
	N	100
Item_24	Pearson Correlation	,367**
	Sig. (2-tailed)	,000
	N	100
Item_25	Pearson Correlation	,233*
	Sig. (2-tailed)	,020
	N	100
Item_26	Pearson Correlation	,310**
	Sig. (2-tailed)	,002
	N	100
Item_27	Pearson Correlation	,489**
	Sig. (2-tailed)	,000
	N	100
Item_28	Pearson Correlation	,346**
	Sig. (2-tailed)	,000
	N	100
Item_29	Pearson Correlation	,583**
	Sig. (2-tailed)	,000
	N	100
Item_30	Pearson Correlation	,490**
	Sig. (2-tailed)	,000
	N	100
Item_31	Pearson Correlation	,513**
	Sig. (2-tailed)	,000
	N	100

		Total_Score
Item_14	Pearson Correlation	,513**
	Sig. (2-tailed)	,000
	N	100
Item_15	Pearson Correlation	,349**
	Sig. (2-tailed)	,000
	N	100
Item_16	Pearson Correlation	,389**
	Sig. (2-tailed)	,000
	N	100
Item_17	Pearson Correlation	,395**
	Sig. (2-tailed)	,000
	N	100
Item_18	Pearson Correlation	,502**
	Sig. (2-tailed)	,000
	N	100

		Total_Score
Item_32	Pearson Correlation	,306**
	Sig. (2-tailed)	,002
	N	100
Item_33	Pearson Correlation	,398**
	Sig. (2-tailed)	,000
	N	100
Item_34	Pearson Correlation	,325**
	Sig. (2-tailed)	,001
	N	100
Item_35	Pearson Correlation	,560**
	Sig. (2-tailed)	,000
	N	100
Total_Score	Pearson Correlation	1
	Sig. (2-tailed)	
	N	100

**. Correlation is significant at the 0.01 level (2-tailed).

4.3.5 Reliability Test of the Questionnaire

The reliability test is conducted to see whether the questionnaire has similar result when it is used on repeated trials (Carmines & Zeller, 1979). The reliability test was done by using SPSS software by considering the questionnaire as one measurement tool. The reliability test result of Safety Culture Maturity Level questionnaire for all participants is then compared to the standard of acceptable alpha, which is commonly around 0.65 to 0.8 at minimum (Goforth, 2015). The reliability test result is shown in the Table 4.22.

Table 4.22 Cronbach's Alpha Reliability Test result

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,860	,860	35

The Reliability test result of Safety Culture Maturity Level questionnaire shows the result of Conbach's Alpha with the value of 0,860. This indicates that the questionnaire has high level of internal consistency (realibility) with the specific sample. A reliable questionnaire means that it could be used many times, and still yield similar result for each iteration.

Table 4.23 Cronbach's Alpha Reliability Test Item-total Statistics Result

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Item_1	,248	,859
Item_2	,306	,858
Item_3	,414	,855
Item_4	,351	,857
Item_5	,200	,859
Item_6	,315	,858
Item_7	,243	,859
Item_8	,250	,859
Item_9	,484	,853
Item_10	,437	,854
Item_11	,429	,855
Item_12	,522	,853
Item_13	,277	,858
Item_14	,455	,854
Item_15	,284	,858
Item_16	,326	,857
Item_17	,342	,857
Item_18	,446	,854
Item_19	,231	,859
Item_20	,495	,853
Item_21	,459	,854
Item_22	,459	,854
Item_23	,351	,857
Item_24	,303	,858
Item_25	,170	,861
Item_26	,244	,859
Item_27	,433	,855
Item_28	,282	,858
Item_29	,534	,852
Item_30	,439	,855
Item_31	,453	,854
Item_32	,240	,859
Item_33	,336	,857
Item_34	,257	,859
Item_35	,510	,853

The table above shows the result of the Item-Total Statistics which presents the scenario of "Cronbach's Alpha if Item Deleted". The column in the table shows

the new value of Cronbach'a Alpha when particular item was going to be deleted. It can be seen that the removal of any question, except for item 25, would lead to a lower value of Cronbahc's Alpha. Therefore, it is not wanted to remove these questions. Removal of item 25 would lead to a small improvement in Cronbach's alpha value, and it could also be seen that the Corrected Item-Total Correlation value was low (0.170) for this item. This might lead to consider whether the item should be removed or not. The higher the value the stronger it is considered to be removed.

4.3.6 Data Recapitulation for each factor

The data recapitulation result of the Safety Culture assessment in Commercial Department, which is grouped based on the factor is presented in Table 4.24. The calculation process of factor value was using the equation (3.4) which is presented in previous chapter.

Table 4.24 Safety Culture Maturity Level based on the Factors

Factor	TFN 1	TFN 2	TFN 3	Rank	Item	TFN 1	TFN 2	TFN 3	Rank
Competence	2,980	3,965	4,590	1	Item 23	2,82	3,8	4,56	1
					Item 24	3,38	4,35	4,74	32
					Item 25	2,85	3,84	4,54	2
					Item 26	2,87	3,87	4,52	4
Leadership	3,075	4,055	4,628	2	Item 6	3,15	4,12	4,68	17
					Item 7	3,13	4,11	4,65	16
					Item 8	3,04	4,02	4,58	9
					Item 9	2,98	3,97	4,6	6
Risk	3,076	4,062	4,634	3	Item 18	3,29	4,26	4,73	28
					Item 19	2,9	3,89	4,56	5
					Item 20	3,14	4,12	4,66	18
					Item 21	3,06	4,05	4,62	10
					Item 22	2,99	3,99	4,6	7
Information & Communication	3,115	4,098	4,658	4	Item 27	3,19	4,17	4,7	21
					Item 28	3,04	4,02	4,64	8
					Item 29	2,86	3,85	4,51	3
					Item 30	3,37	4,35	4,78	33
Organisation Learning	3,168	4,168	4,652	5	Item 31	3,29	4,27	4,68	29
					Item 32	3,07	4,06	4,61	11
					Item 33	3,12	4,12	4,64	19
					Item 34	3,2	4,19	4,65	23

Factor	TFN 1	TFN 2	TFN 3	Rank	Item	TFN 1	TFN 2	TFN 3	Rank
					Item 35	3,2	4,2	4,68	25
Responsibility	3,185	4,170	4,685	6	Item 10	3,09	4,08	4,62	14
					Item 11	3,33	4,31	4,73	30
					Item 12	3,24	4,22	4,73	26
					Item 13	3,08	4,07	4,66	13
Commitment	3,216	4,208	4,772	7	Item 1	3,15	4,14	4,84	20
					Item 2	3,12	4,11	4,6	15
					Item 3	3,09	4,07	4,62	12
					Item 4	3,2	4,2	4,88	24
					Item 5	3,52	4,52	4,92	35
Engagement & Involvement	3,325	4,310	4,730	8	Item 14	3,2	4,19	4,65	22
					Item 15	3,36	4,35	4,74	31
					Item 16	3,29	4,26	4,73	27
					Item 17	3,45	4,44	4,8	34

The result of the data are ranked from the smallest to largest based on the TFN 2 (mean) value. The shaded region which consist of four factors have the value below the Maturity Level. Figure 4.12 shows the chart of the factor maturity level.

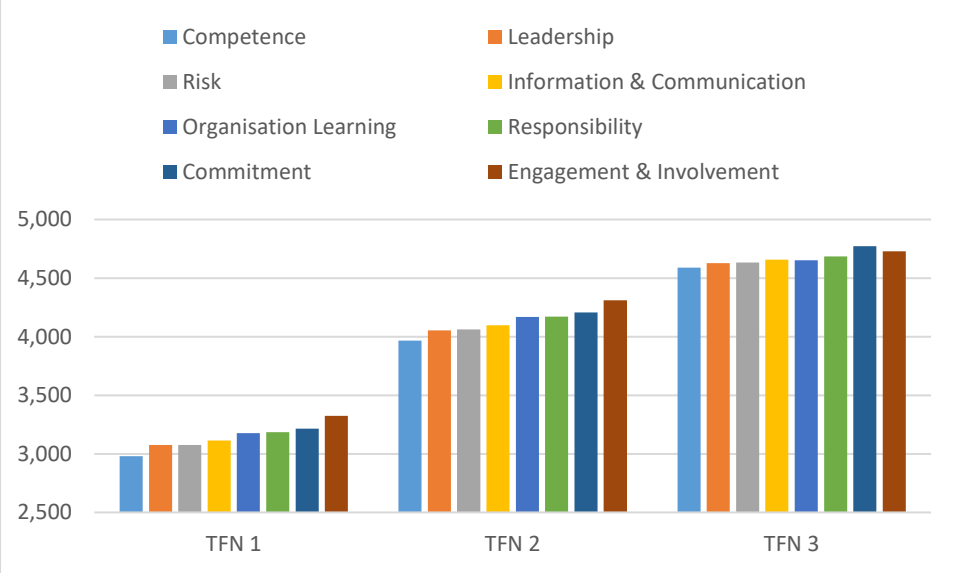

Figure 4.12 Bar Chart of Maturity Level TFN of each Factor

4.3.7 Data Recapitulation for each section

The data recapitulation result of the Safety Culture assessment in Commercial Department, which is grouped based on each section to show its aspect

value, is presented in Table 4.25 the calculation process of aspect value was using the equation (3.1) and the calculation of section maturity level was using the equation (3.2) which are presented in previous chapter.

Table 4.25 Safety Culture Maturity Level in each Section (based on aspects)

Section/Aspect	*Psychological*			*Behavioral*			Maturity Level			Rank
	TFN 1	TFN 2	TFN 3	TFN 1	TFN 2	TFN 3	TFN 1	TFN 2	TFN 3	
Tank Farm	2,94	3,93	4,54	3,17	4,16	4,68	3,01	4,00	4,59	1
GBJ	2,98	3,97	4,59	3,14	4,12	4,66	3,07	4,06	4,63	2
Bulk Filling	3,06	4,06	4,67	3,31	4,28	4,70	3,21	4,20	4,71	3
Packaging	3,14	4,13	4,69	3,31	4,30	4,77	3,21	4,20	4,72	4
Weighbridge	3,34	4,30	4,69	3,31	4,29	4,69	3,29	4,25	4,67	5
Terminal CPO	3,33	4,33	4,77	3,38	4,38	4,79	3,29	4,29	4,77	6
				Department Maturity Level			3,14	4,13	4,67	

Table 4.25 Safety Culture Maturity Level in each Section (based on aspects) – (continuation)

Section/Aspect	*Situational*			Maturity Level			Rank
	TFN 1	TFN 2	TFN 3	TFN 1	TFN 2	TFN 3	
Tank Farm	2,90	3,88	4,53	3,01	4,00	4,59	1
GBJ	3,14	4,12	4,67	3,07	4,06	4,63	2
Bulk Filling	3,31	4,30	4,79	3,21	4,20	4,71	3
Packaging	3,19	4,18	4,71	3,21	4,20	4,72	4
Weighbridge	3,17	4,11	4,61	3,29	4,25	4,67	5
Terminal CPO	3,07	4,07	4,72	3,29	4,29	4,77	6
	Department Maturity Level			3,14	4,13	4,67	

The result of the data are ranked based on the TFN 2 value of section maturity level from the smallest to largest value. The shaded region which consist of two section have the value below the Department Maturity Level. Figure 4.13 shows the chart of the section maturity level.

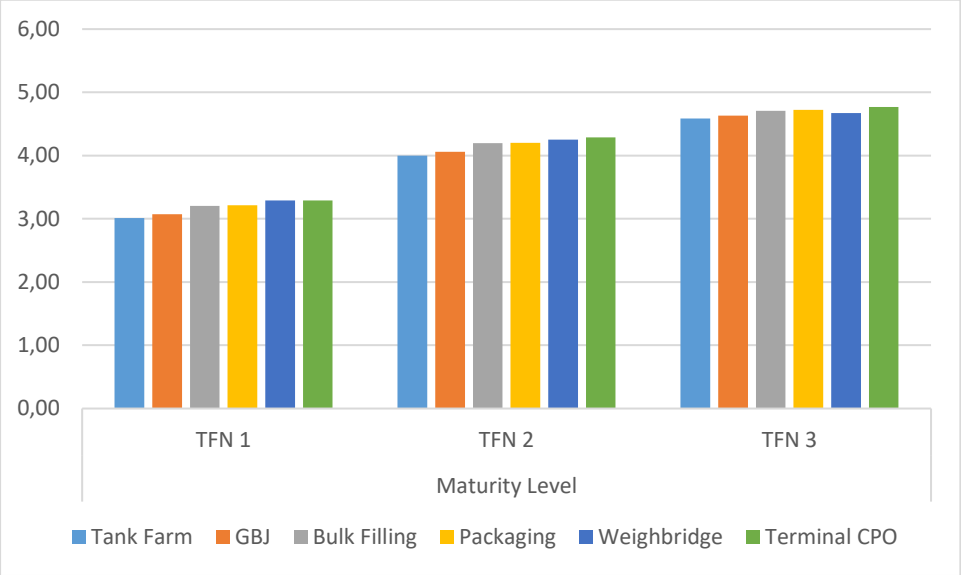

Figure 4.13 Bar Chart of Maturity Level TFN in each Section

Figure 4.14 shows the chart of the aspect value in each section of Commercial Department. Figure 4.15 presents the radar chart of which compare the aspect value between GBJ section and Operation Tank Farm section, which have the lower maturity level.

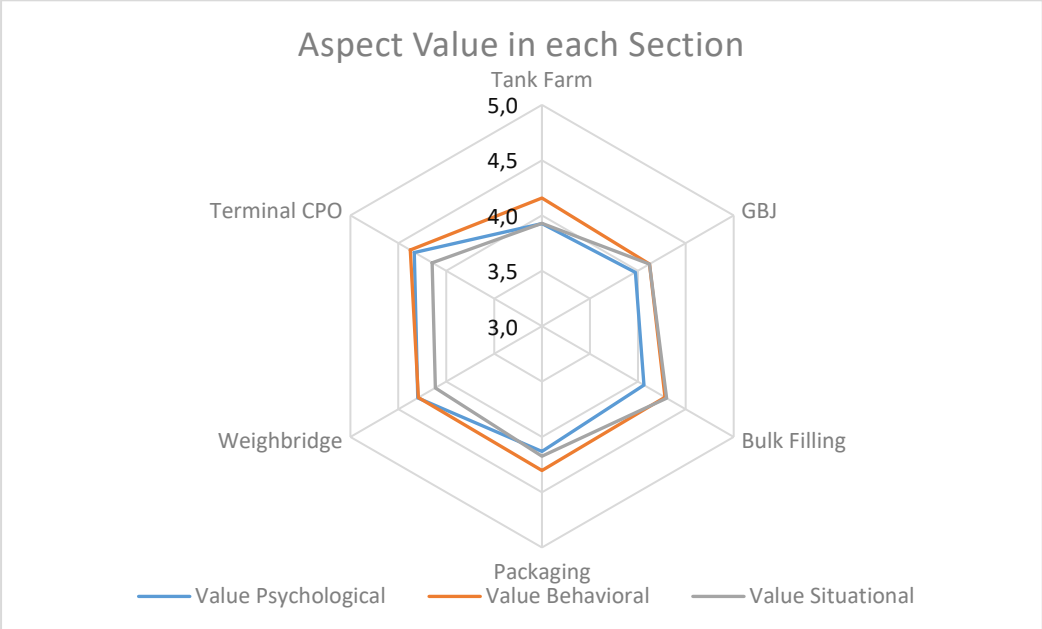

Figure 4.14 Radar Chart of Aspect Value in each Section

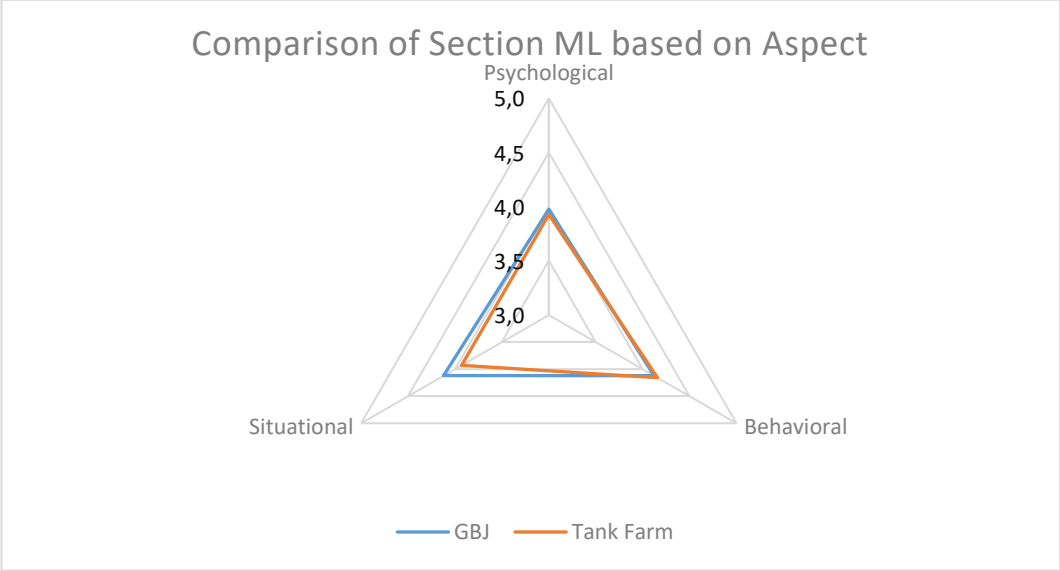

Figure 4.15 Radar Chart of the Comparison between Section Maturity Level based on Aspect

4.3.8 Comparison of Factor Maturity Level and Section Maturity Level

The data recapitulation result of the Safety Culture assessment in Commercial Department, which is grouped based on each section to show its factor value, is presented in Table 4.26 It is used to compare the maturity of the factors and the section. The calculation process of factor value on each section was using the equation (3.3) which are presented in previous chapter.

Table 4.26 Data Recapitulation of Factor Value in each Section

Figure 4.16 is a radar chart which shows comparison between maturity levels of four factors based on each section. Figure 4.17 presents a radar chart which shows comparison between maturity levels of two section based on each factor.

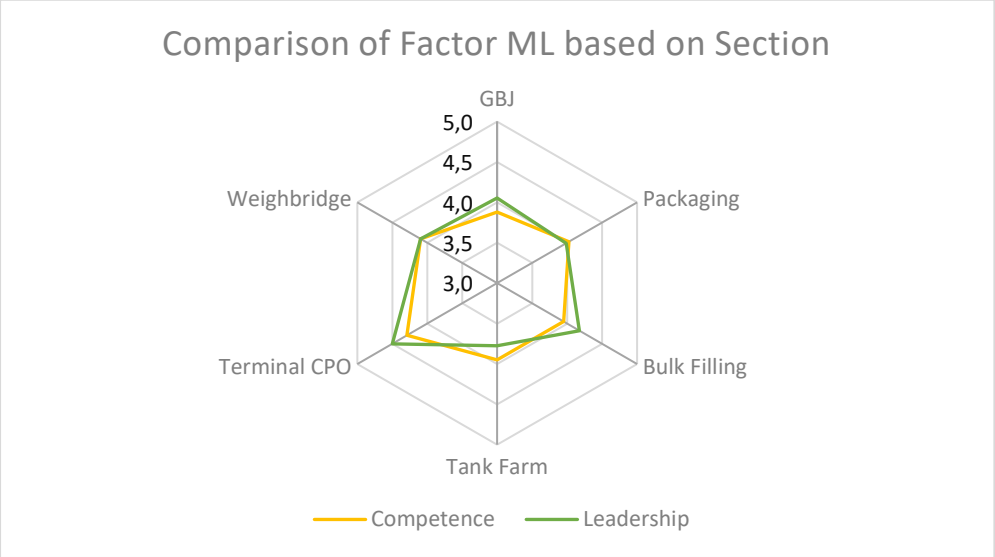

Figure 4.16 Radar Chart of the Comparison between Factor Maturity Level based on each Section

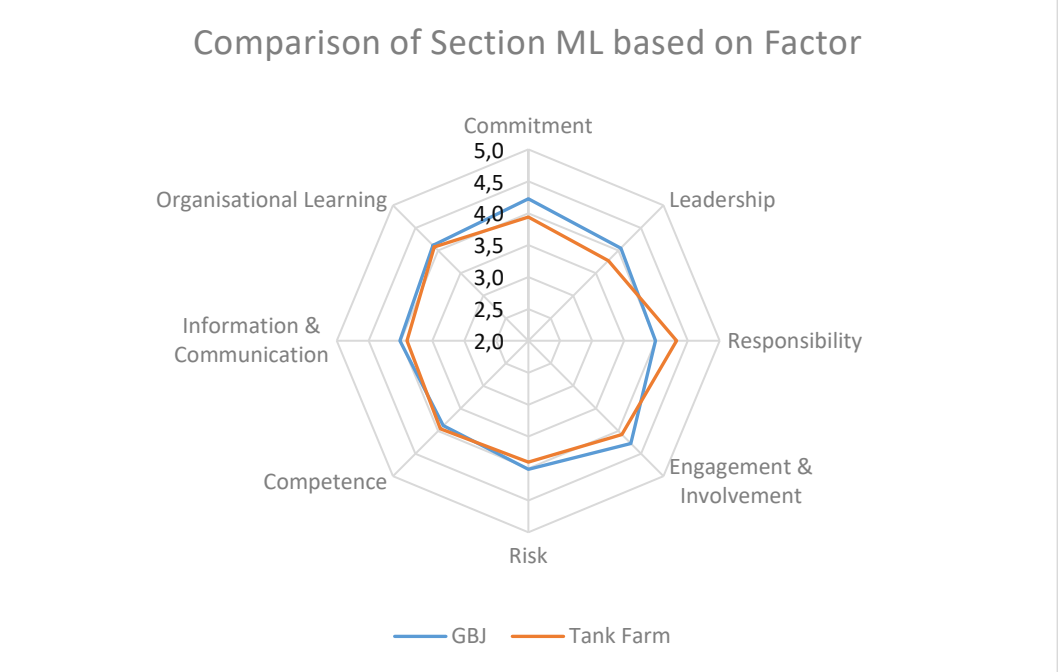

Figure 4.17 Radar Chart of the Comparison between Section Maturity Level based on Factor

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CHAPTER 5
INTERPRETATION AND ANALYSIS

In this chapter will be discussed about the data interpretation and analysis of the assessment from the previous chapter. It is done on the result of the questionnaire, the assessment result, comparison maturity level between section and also factors. This chapter also discuss about the improvement and recommendation plan in the company.

5.1 Analysis of the Questionnaire Result

The questionnaire development process has passed through three times of iteration. The final result of the assessment instruments are consisting of 35 indicators to be measured. The first iteration is the collection of indicators from various sources and references. The second iteration is the adjustment and selection process of the framework in accordance with the company which was accompanied by the safety expert during the process. The third iteration is the formal questionnaire development and several adjustment. It was also done a review and evaluation by the one of the section head in Commercial Department.

Questionnaires are measurement instruments. Reliability and validity are measuring of how well the instrument works. The questionnaire development result was tested using validity and reliability test. Data processing result shows that Safety Culture Maturity Level Questionnaire is valid and reliable. This means it could be implemented in a logistic department of a company to measure its maturity level of safety culture. The validity of the questionnaire was proven by the Pearson correlation test while the reliability was calculated using the Cronbach's alpha. Pearson correlation value of all items are greater than the r value (0,195) for the questionnaire testing shows that all of the items has significant effect to the total score with significance level of 0.01 (2-tailed test). The significant value of all items in the questionnaire are also below the alpha (0,05), which means that all of the instruments items are valid. Validity means that the concept measured is actually the one the researcher intended. Reliability test gave the similar result that the questionnaire value of Cronbach's alpha is 0,860 which indicates a high level of

internal consistency (reliable). As the value surpasses the minimum standard of 0,65, the questionnaire items could be said to reliable. Questionnaire reliability indicates how closely the results of repeated measurements of the same concept agree, a reliable measurement known not to have changed that is performed twice with the same person will produce the same value both times.

The result of safety culture aspects weighting is that psychological aspect is the most prioritized aspect which is shown by the greatest value of importance proportion compared to other two aspect. Psychological, behavioral and situational aspect importance level value are 0.415, 0.358 and 0.227 respectively. The weighting calculation was using Expert Choice software (AHP method) which are participated by three expert of safety in the company. Psychological aspect occupied the first position because it is claimed to be the importance aspect to be considered before others. Psychological aspect is the perception which comes from every individual. It is needed to control and manage the individual value before focus on the behavioral and situational. Since behavioral value is also could be said as the product of the psychological thinking in form of actions either individually or in groups. Controlling the psychological aspects first to form a good behavioral of the organisation. The situational aspect is in third position means that it is the complementary requirement that a company need to have, to control and monitor an organisation continuously in order to maintain the good performance of the system.

The assessment process in this research was conducted in two iteration process. Data adequacy test was performed to determine whether the sample of data collected have fulfilled the required data sample size (N'). The first iteration collected 70 people as respondents, and the second iteration required additional respondent for at least 28 people. The final result is that the sample size is 100 resulting in sufficient sample for all of the items in the questionnaire, means that the required sample have already met.

5.2 Analysis of Commercial Department Maturity Level Result

The final result of the safety culture maturity level calculation is that Commercial Department has the Kernel value of 4,126, Minimum value of 3,138 and Maximum value of 4,666. The interpretation of these results start from score 1 to 5 are upon the scale of Pathological, Reactive, Bureaucratic or Calculative, Proactive and Generative or Sustainable. Refer to the Figure 4.10 of fuzzy score interpretation, the Kernel (most likely) value may be interpreted as the company safety culture maturity level is close to the Proactive level. The Minimum (lowest likely) value may be interpreted as the company safety culture maturity level is close to the Bureaucratic level. The Maximum (greatest likely) value may be interpreted as the company safety culture maturity level is between the Proactive and Generative level.

In this formulation, the kernel value is identical to the weighted average (or mean) score recorded. Thus, the current level of safety culture in the department is in development process. There are some indicators that shows the implementation is still in bureaucratic level, but there are also many indicators that has already in proactive which close to generative level. However, the kernel value is indicating that the company has already in proactive level and still growing to be in higher level. Referring to this result, it can be said that the department should have improved performance in safety aspect. Preventive actions has already been done by doing anticipation of safety problem before they arise. The safety program should have already implemented well with structured and systematical way, even though it has not been integrated with other work areas yet. The majority of the employee in the department should have followed the OSH aspects. They should frequently do safety behaviors actions at work.

The safety culture maturity value consist of psychological, behavioral and situational aspect which have the TFN value of (3.067, 4.057, 4.633), (3.220, 4.207, 4.698) and (3.140, 4.123, 4.677) respectively. The kernel value of behavioral and situational aspect are somewhat considered as more than the proactive level while the kernel value of psychological aspect is close to this level. The overall maturity level is still considered as somewhat more than this level (4.126). Generally the

current level of the department maturity level has just already passed the proactive level indicated by the psychological aspect is still close to this level. The minimum value of psychological aspect is close to the bureaucratic level while for behavioral and situational aspect are somewhat more than the level of bureaucratic. Compared to the overall maturity result minimum value (3.138) which is still considered more than bureaucratic level, the company's current condition can be said that several safety indicators are still in bureaucratic level, especially for the psychological aspect indicators which contributes to the lowest level of maturity level. At the maximum level, again the psychological aspect is one degree lower than the behavioral and situational level. It has already in between the proactive and generative level while the other somewhat have already close to generative level. It can be said that the company is in developing process from the proactive to generative level of safety culture. However the result do not show that the indicators has already close to the level of generative. Mainly they are in proactive level while several are still in bureaucratic or at the lower level.

To link the result of this assessment and the real condition of the company could be seen at the programs concerning to OSH. The company has already implemented OSH Management System as mentioned in previous section. The programs are already structured and planned well to overcome several aspects related to safety, for instance the commitment construction, safety related record, reporting regulations and others. This could represent the situational aspect of the company, where the result is in proactive level. Further improvement for the current management system are still needed. The company also implemented behavior based safety programs, with one of the product is D'safe record system. It records any safety related actions and conditions, both positive and negative, which involve the entire employee at the company. This program could represent the implementation of behavioral aspect. According to the result that already in proactive level, it has been implemented well but still need further improvement for more effective and efficient system. The psychological things in the company generally could not be found. A simple example is the control and monitor

employees commitment. However, it cannot ensure that the employees really aware and concerns to safety aspects.

Refer to the weight result of the aspects, psychological aspect has the highest importance level compared to other two aspects. While the result of this aspect is at the lowest value. It becomes logical that the experts said psychological aspect should be the concerns in the company when the value is low. The further improvement recommendation for the company is that psychological aspect has to be the concerns to build the individual perceptions and value regarding safety.

5.3 Analysis of Factor Maturity Level

The factors value were ranked from smallest to the largest to know the position of each factor relative to the department maturity level. There are four factors which has the value below the kernel value of maturity level, those are competence, leadership, risk, information and communication, from the lowest to the highest.

Competence has the lowest kernel value of maturity level with value of 3,965 which could be interpreted as nearly reach the proactive. The minimum value of this factor is 2.98 which could be interpreted as in reactive level but has closed to bureaucratic level. The maximum level is still in between bureaucratic and generative level. This factor still have many indicators which the implementation are in level lower than bureaucratic. This factor represented by the item 23 to item 26 in the questionnaire. Item 23, 25 and 26 included in top five of lowest kernel maturity level which have the value below 4. It means that they are still somewhat close to proactive level that is actually still in bureaucratic level. Item 23 assess indicator of the clearness of job description in the company, meaning that the implementation of job description is currently not very good enough. Some employee presume that the job description provided by the company have not clearly explained concerning the responsibility, task, competence required. The company should not only give the job description but also need to review and evaluate continuously to check whether the employee already understand. Item 25 is about the cause of accident analysis, the company seems to only try to find the

cause of accident not the root cause of the accident, and worse sometimes the company also looking for the subject. Item 26 is about the training typical in accordance with the jobs type. It still need to be improved regarding the suitability of the training and required to do review and evaluation to the training program. For the item 24 turns out to have the high value of kernel maturity level. It reached the value of 4.35 which can be interpreted as having the value between proactive and generative. This can be said that the education to improve the employee's competence for risk control has already implemented regularly.

The second lowest value of kernel maturity level is in leadership factor with the value of 4.055. Start from this factor the maturity level has already reached the proactive level. It can be said that leadership factor has close value to this level. Even though the minimum value is still close to bureaucratic (3.075), means that several indicators are still in lower level of implementation. The indicators representing this factors are in item 6 to 9. Item 9 which measures the intensity of speeches conducted by the supervisor has the lowest kernel value, and the only one with value lower than 4. It indicates that the Supervisor has already conduct the speech as regulated by the company, but the frequencies of the speeches need to be increased and make this agenda to the priority concerning safety. Other indicators has the kernel value close to proactive level, minimum value close to bureaucratic and maximum value between proactive and generative.

Risk factor has the kernel value slightly higher than leadership. It has the same interpretation of the score that already close to proactive level. There are 5 items representing this factor. Two of them (item 19 and 22) have the kernel value close to the proactive level while the other have already reached value of 4. These indicators are cleanliness of work equipment and the effectiveness of safety patrol. Refer to the accident record, one of the incident happened is that the operator get something like dust get into his eye. The company should be aware that cleanliness of the work equipment are important. There are minimum value of risk indicators which are still below 3, which indicated there are still implementation of safety culture in reactive level. However in general, the implementation have already in accordance with the OSH regulations. Even though several employees presume that

they have not conducted in structured and systematic way. The other indicators have the mean value kind of more than proactive level. While the minimum value have also reached the bureaucratic level and the maximum value are in between proactive and generative level.

The information and communication factor is nearly have the same kernel value as risk factor. It is closely higher in proactive level. The minimum value is also somewhat more than the bureaucratic, not close enough. There is only one indicator (item 29) about the freedom of communication to express unsafe action and condition without waiting to communication forum, which has the value below 4. It is interpreted as slightly less than the proactive level. The company still have formal communication way of expressing the safety–related issues. The other indicators are discussion related to safety, information about near miss incident and clearness of work instructions have already implemented to be the preventive actions. Even though the performances still could be improved.

The maturity level of remaining four factors are somewhat more than the proactive level with value above 4.1.The minimum value are all above 3 could be interpreted as no more indicators are in reactive level, while maximum value have reached 4.6 indicate that several indicators have already in generative level. The entire indicators of these level have kernel value more than 4 means that they certainly are all in proactive level. For the organisation learning, item 32 and 33 which measure sharing knowledge, experiences and discussion among the stakeholders is the lowest both concerning OSH implementation and near miss incident. The awareness of the employees has to be improved to encourage them to always concern with safety aspects.

Responsibility factor has the value of TFN almost the same with organisational learning. The lowest two indicators are item 10 and 13 about the employees' response to unsafe actions of the co-workers and also to unsafe conditions, hazards, as well as near miss incident. Several employees have already remind their co-workers and report to the unsafe conditions, but there are still no further actions for instance to ensure that the unsafe actions would not be done again and the near miss incident would be directly handled.

Commitment factor in the company has good result proven by the kernel value of management in performing the work safety procedures is already in position of close to the generative level. The low value is shown by the encouragement to work in safety resulting on some employees performances related to safety are still low, according to the discussion at the previous factors.

The last factor with the highest value of maturity level is engagement and involvement. The stakeholder in the company have already participated in all aspects of safety while the management has already facilitated and given opportunities to the employees to be involved in safety programs. However, if it is looked at the maximum value of the indicators, it can be interpreted that the value are still between the proactive and generative level. No indicators reached the score close to generative level. Further improvement are still needed to be done.

5.4 Analysis of Section Maturity Level

Based on the result on data processing, Table 4.25 presents the safety culture maturity level triangular fuzzy number of each section, based on aspects value. It is clearly shown that the kernel value of the entire section have minimum value of 4. It could be interpreted that at least the section level have already achieve proactive level. The minimum (lowest likely) value of the section have already close to bureaucratic level. It means there are not any section is still in reactive level. However, none of the maximum (greatest likely) value of all sections is close to the generative level. Most of them can be interpreted as somewhat less than generative level. Overall, the sections safety culture in commercial department are currently growing for better maturity level. In average they are in proactive level, with several indicators are still in bureaucratic but some others are developing to generative level.

The result of sections maturity level is ranked from the smallest to highest based on the kernel value. Tank Farm and GBJ has the lowest value which are below the department maturity level. These sections have slightly the same TFN value. Refer to the accident record in commercial department presented in Table 4.1 and 4.2, these two section are the only contributors of the accident occurrence. It would

be pretty accurate that the value of maturity level of these section are the lowest which make them have high possibilities of occupational accident. GBJ have higher value in psychological and situational aspect value, while tank farm has higher value in behavioral aspect value. The accident causes in GBJ are mainly caused by behavioral aspect, such as human error and do not wear PPE. While accidents happened in Tank Farm are basically caused by unsafe conditions which are representation of situational aspect. These two fact supports the result of low behavioral value in GBJ and low situational value in Tank Farm.

The result of other sections maturity level based on the kernel value, are mainly in position of somewhat more than the proactive level. The minimum value are also somewhat more than the bureaucratic level. These sections have higher value of TFN maturity level than the department overall value.

5.5 Analysis on the Comparison of Factor Maturity Level and Section Maturity Level

The data used to compare the maturity level between factors and sections are the kernel value of TFN. The Table 4.26 presents the factors contributing to each of section maturity level. The highlighted data are the top two section and factors which have the lowest maturity value.

Tank Farm has the lowest value of maturity level. There are five factors which have the value below 4 occupying Tank Farm section. The lowest value is in terms of leadership. While in leadership factor itself, Tank Farm also has the lowest contribution to overall factor value with score of 3.78. This could be considered as the lowest contribution to overall safety culture maturity occupied by leadership factor in Tank Farm section. It should be the priority to be improved for higher level of safety culture maturity level. Other than that, the competence factor in Tank Farm is also in low level. It is slightly higher than the lowest value which is occupied by GBJ section.

GBJ section lowest value based on its factors is occupied by competence with the value of 3.88. Competence factors is also the lowest factors value in the entire commercial department. Comparing the competence value to other section,

the lowest is occupied by GBJ section. It can concluded that the competence factors in GBJ contributes to the lowest safety culture implementation, other than leadership factor in Tank Farm section. Thus, the improvement would be prioritized in this part. Other than that, responsibility factor also has value under 4. However other section have high value (above 4) in terms of responsibility. For leadership factor, it is not the lowest value which is actually occupied by Tank Farm.

Refer to figure 4.16 about the comparison of GBJ and Tank Farm maturity level based on the factors, GBJ seems to have most of the factors value greater than the Tank Farm. In responsibility factor Tank Farm has far differences with GBJ which only has the value below 4. The value of commitment, leadership, engagement & involvement is in GBJ are slightly higher than what Tank Farm has. While other factors such as organisation learning, information & communication, risk and competence has almost the same value between the two sections.

Some other things that could be concerned are the one with value lower than 4. However, according to the data in Table 4.26, the data which have score below 4 are if not occupied by the leadership and competence factor then they are occupied by GBJ and Tank Farm section. GBJ have low value of responsibility while Tank Farm have low commitment, risk, and information & communication. The other section which have low value are packaging occupied by leadership factor and Bulk Filling occupied by competence factor.

5.6 Improvement and Recommendation

The improvement recommendation would be presented in a table. The discussion of improvement are made on each factor. By analyzing the items contributing to each factors, improvement plan could be made to increase the level of the factor. When the overall factors are improved, sections in the department should also be improved, in all type of factors. Table 5.1 presents the analysis of improvement recommendation based on each factor, with the contributing items.

Table 5.1 Recommendation of Improvement based on each Factor

Factor	Rank	Item	Rank	Improvement Recommendation
Competence	1	Item 23	1	The ability of the employee need to be improved regularly especially when concerning to occupational safety and health. Starting from the training compatibility as needed by each work type of the employees. Not only conducted accordingly but also need to be reviewed and evaluated to improve the quality and effectiveness. It is also related to have continuous education to improve the risk control competence. Above all, when doing the accident analysis the company should focus on finding the root causes instead of the subject. It is expected to prevent recurrence of accident by mitigating the basic cause of accidents
		Item 24	32	
		Item 25	2	
		Item 26	4	
	Operational Plan			Safety Training based on Job Type (e.g. forklift safety training, truck/container safety driving), Review and Evaluate annually training programs, Build a team to do analysis on any incidents and accidents root causes.
Leadership	2	Item 6	17	The company should be better to prioritize the importance of safety aspects at work so that it would be a responsibility and needs to encourage the employee to always follow the safety aspects. The management could improve the performances by ensuring any work-related are always in safe condition (including work area condition, tools and equipment used).
		Item 7	16	
		Item 8	9	
		Item 9	6	

Table 5.1 Recommendation of Improvement based on each Factor (continuation)

Factor	Rank	Item	Rank	Improvement Recommendation
	Operational Plan			Still need Reward system for employees (but no punishment), Rank (pool) for each department on safety performances, Create an event to motivate and increase awareness of employes (fun competition but educative).
Engagement & Involvement	8	Item 14	22	The entire stakeholders have already participated in safety aspects, while the company has also facilitating well. Further improvement that could be done are to always ensure regularly that every worker could perform well while complying to safety aspects, the company could always do review and evaluation regarding safety programs participated by the employees.
		Item 15	31	
		Item 16	27	
		Item 17	34	
		Operational Plan		Obligation for employee to participate the safety programs, Reward for most active employee concerning safety.

5.7 Discussion of the Research

This part of analysis are the discussion of several things related to the research. Those are the research case study chosen, the assessment result and the benefits for the company, the utility and flexibility of framework developed, and the next plan on the research result.

5.7.1 Research Case Study

This research was focused on developing the safety maturity framework which then used to assess the safety culture implementation level in a company. However the condition was limited to the object of the research. Firstly it was aimed to implement the framework to measure a manufacturing company as a whole. Unfortunately the related company did not allow any external parties to assess the whole company. Another boundary is that the research time coincide with the peak season of the company, making the company in their busiest moment. Production department should be the selected object to be measured. However, this department was also prohibited to be observed by the external parties. The alternative was to assess in Commercial Department which focus on logistic activities. It turned out that this department has moderate to high risk of occupational accident. The department was also the most contributing in accidents and incidents occurrences to the company.

5.7.2 Assessment Result and Its Benefits to the Company

The result of the maturity level was described by an interval score from the minimum, mid-point and maximum value. It should be interpreted by considering its ambiguity to develop the improvement plan. However, if it is needed to state a single result of safety culture maturity level. The kernel value should most represent the overall result, with the tendencies to the closest range between minimum and maximum values. Thus, the company's current condition is in proactive level.

Most of the company especially in manufacturing company have already implemented the OSH Management System. However, many of them still could not implement effectively. Occupational accidents and incidents were still happening. Then one of the method could be used is to measure the maturity of the safety

culture. It is used to know how well safety management in a company. Then evaluation can be made to determine the improvement plan. When the result of measurement are good, then the company could decide to maintain the good ones while improve others. Other benefit of measuring the safety culture is to make sure that safety did not only comply with regulations (situational aspect) but also behavioral and psychological aspect. It is also used to increase the safety image of the company as well as increase the awareness of safety culture importance in the implementation of Occupational Safety and Health.

5.7.3 Framework Utility and Flexibility

The framework developed in this research was basically made in general perspective of business process. It was not only specified for the logistics activities or logistics company. This research was focused on PT SMART as a manufacturing company. The inidactors were developed in general terms, not specifically for logistics. The flexibility of the framework to be used in another company could be analyzed from each factors and their indicators. Basically the indicators were developed in a common way but the questionnaire design were made based on the type of the object.

The analysis of flexibility would be done in comparison with other manufacturing company with different bussiness process, which include mining, oil and gas industry, and other type of manufacturing industry. Refer to Table 5.2, commitment factor have 3 common indicators which are applicable to any manufacturing industries. Indicator C-8 with item number 2, consider outsources party, then the usage is limited only in a company which cooperate with outsourcing parties. Indicator C-11 could be adjusted based on the job types and work area which are going to be measured.

Leadership factor haev 3 common indicators and 1 that could be adjustable. In example, indicator L-7 could be said as common factor because supervisor encouragement to safety should be applicable in any types of industry. Indicator L-3 for work equipments could be specified only for particular work equipments based on the type of industry.

Responsibility factor have 3 common indicator and 1 limited indicator to be used in other company. Indicator R-2 about employee response to unsafe actions is a common instruments that could be measured in any type of manufacturing industries. Indicator R-7 is limited to company which implement extra work hour (overtime) system. However, nowadays most of manufacturing company should have the overtime working hour system.

Engagement and involvement, competence, information & communication, organisational learning factors have all of their item as common indicators. Indicator EI-3 is about employee contribution to work in safety. It is general that any employee from all types of industry should be measured their involvement to safety. Indicator CO-5 concerns to continuous eduaction in a company. Normally, any company shall do education and training to increase their employees' competence. Indicator IC-4 measure the discussion related to safety issues, where communication is a common thing in an organisation. Indicator OL-5 and OL-6 is about sharing knowledge and experiences among stakeholders where it should be occured in a common company.

Risk factor have 2 indicators that need to be adjusted to be implemented to other company. Indicator RI-9 is about the cleanliness of work equipments. This indicator is general, but the questionnaire item could be different based on the equipments used at particular company. For instance, in a storaging work area the common equipments are forklift, industrial truck, etc. while in a mining site the equipments could be drilling machine, grinding machine, etc. For the indicator R-11 regarding shift hand-over, it would be limited only for company which implement shift work system.

In conclusion, the framework were consist of mainly common indicators and some of them are limited and adjustable. The questionnaire design including the questions and options could be developed as needed (to be more specific) in accordance with the type of the company.

Table 5.2 Indicators Flexibility to be Applicated in other Company

Question Number	Factor	ID	Indicator	Application Flexibility
Item 5	Commitment	C-6	Commitment of Management in performing the work safety procedures	Common Indicator
Item 1		C-7	OSH policy establishment in form of reward and punishment system	Common Indicator
Item 2		C-8	Safety aspects consideration while cooperating with outsourcing parties	Company with outsources only
Item 3		C-10	Company encouragement to work according to safety rules	Common Indicator
Item 4		C-11	Commitment to ensure all types of jobs at the work area (operation and maintenance) comply the safety aspect	Can be specified for certain job types/work area
Item 6	Leadership	L-1	Supervisors inspection of safety to their work unit	General Indicator
Item 7		L-3	Ensure the work equipments meet the safety standard	Can be specified for certain work equipments
Item 8		L-7	Supervisor encouragement to work in safety	General Indicator
Item 9		L-10	Supervisor speeches concerning OSH	General Indicator
Item 10	Responsibility	R-2	Employee response to unsafe actions of his co-workers	General Indicator
Item 13		R-4	Employees reporting to near miss incident, and hazards potential	General Indicator
Item 11		R-7	Supervisors monitor during the overtime and holiday	Limited for company with extra work hour (overtime)
Item 12		R-8	OSH workforce performance in taking the OSH role	Common Indicator
Item 14	Engagement and Involvement	EI-3	Employee contribution to work safety environment	Common Indicator
Item 15		EI-4	Open communication system concerning unsafe action and condition	Common Indicator

Table 5.2 Indicators Flexibility to be Applicated in other Company (continuation)

Question Number	Factor	ID	Indicator	Application Flexibility
Item 17	Engagement and Involvement	EI-5	Response to discussion concerning OSH aspects	Common Indicator
Item 16		EI-6	Employeed participation in OSH coaching	Common Indicator
Item 18	Risk	RI-1	Availability of safety tools and sign	Common Indicator
Item 22		RI-3	Effectiveness of safety patrol to control risk and hazard findings	Common Indicator
Item 19		RI-9	Cleanliness of the work equipments	Common Indicator, can be specified for certain type of work equipments
Item 20		RI-11	Shift hand over information system	Limited for company with shift work hour
Item 21		RI-12	Company's act due to smoking violations	Common Indicator
Item 23	Competence	CO-2	Clearness of job description (responsibility, task, position, competence required)	Common Indicator
Item 24		CO-5	Continuous Education to improve competence for risk control	Common Indicator
Item 25		CO-6	The focus on cause of accidents analysis	Common Indicator
Item 26		CO-9	Training compatibility related to work typical	Common Indicator
Item 27	Information and Communication	IC-4	Safety issues disscusion in the work environment	Common Indicator
Item 28		IC-5	The information (billboards, posters, videos, bulletins, etc) about the near miss incident (safety issues) to enhance the employees awareness	Common Indicator
Item 29		IC-7	Freedom to express the unsafe action and condition anytime without communication forum	Common Indicator

Table 5.2 Indicators Flexibility to be Applicated in other Company (continuation)

Question Number	Factor	ID	Indicator	Application Flexibility
Item 30	Information and Communication	IC-11	Clear and understandable work instructions and placed at the strategic locations	Common Indicator
Item 31	Organisation Learning	OL-3	Company openness and responsiveness in following up unsafe condition and action report	Common Indicator
Item 32		OL-5	Sharing knowledge, experience and discussion among stakeholders concerning OSH to ensure its implementation in the company	Common Indicator
Item 33		OL-6	Sharing knowledge, experiences and discussion among stakeholders concerning near miss incident in all work unit	Common Indicator
Item 34		OL-7	Company intensity to analyze the cause of near miss incident	Common Indicator
Item 35		OL-10	Conducting review of OSH Management System	Common Indicator

5.7.4 Maturity Level Result Discussion

The basic purpose after knowing the result of safety culture maturity level are to evaluate and improve the current system. To make an effective improvement strategy, it is needed to know the root of the problem. Safety culture maturity result can be interpreted in different perspective. These interpretation come from the result of section maturity, factor maturity, and overall maturity. The improvement actions can be focused on certain sections, certain factors, or the system as a whole company based on the result. Priority list is needed to be made to plan the improvement strategy.

When the result of the maturity level assessment has already reached the highest level, the company could be a model in performing a good safety culture. This achievement would also be an assest to build trust when cooperating with other parties. It also could encourage and influence the employees to always prioritize safety at work.

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CHAPTER 6
CONCLUSION AND SUGGESTION

In this chapter will be presented the conclusion of the final project research that has been done. It will be also given several suggestions for future research regarding this topic.

6.1 Conclusion

The conclusion that can be made after doing the final project research regarding safety culture maturity level are as follow:

1. The framework development of safety culture maturity level was made in three times of iteration. It started with aspects determination which consist of 3 aspects and then factors determination which consist of 8 factors. Each of the indicators would have indicators to reflect the factor. The first iteration was the collection indicators from several resources and references. The second iteration was the adjustment and selection of indicators which applicable to the object of the research, namely commercial department of PT SMART. The third iteration was the questionnaire development which in accordance with the company condition.
2. The questionnaire development was extracted from the framework that has been made. It consist of 35 questions and each of them have 5 options representing the level of safety culture maturity. The questionnaire development was made in simplified writing, using communicative and simple language, and the options are randomized to maintain the assessment objectivity. Weighting between the aspects of safety culture was conducted to give fair assessment. The questionnaire developed was already tested its validity and reliability.
3. The result of safety culture maturity level in commercial department of PT SMART is represented into Triangular Fuzzy Number (TFN). The result are that the Kernel value is 4,126, Minimum value is 3,138 and Maximum value is 4,666. The Kernel (most likely) value may be

interpreted as the company safety culture maturity level is close to the Proactive level. The Minimum (lowest likely) value may be interpreted as the company safety culture maturity level is close to the Bureaucratic level. The Maximum (greatest likely) value may be interpreted as the company safety culture maturity level is between the Proactive and Generative level. The result of safety culture maturity level are also interpreted in each of the factors as well as the sections. GBJ and Tank Farm have the lowest value of the assessment result, while the factors are occupied by competence and leadership.

4. The recommendation of improvement were given on each factor of safety culture based on the indicators value. The priority of improvement should be applied to competence and leadership factors as these factors have the lowest score. Generally the improvement are needed to develop the current department to reach the generative level of safety culture.

6.2 Suggestion

Suggestions that could be given for future researches related to safety culture maturity level framework development and also the assessment are as follow:

1. The framework developed in this research could be applicated in another sectors of a business industry other than logistic sector. It should be better to be implemented in a whole company. However, the framework have to be adjusted in accordance to the company condition.
2. The questionnaire instruments could be developed to have another factors of safety culture but the aspects should remain the same. It is also better to increase the amount of questions to assess deeper and more accurate.
3. If the framework is implemented in a company, the respondent should be differentiated based on the job position, for instance staff and supervisor. The questionnaire instruments would also be different as well as the weight of the questionnaire score.

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APPENDIX

Appendix A Iteration 1 result of Safety Culture Maturity Level Framework

Factor	Reference	ID	Aspect	Indicator	Level				
					Pathological	Reactive	Bureaucratic/Calculative	Proactive	Sustainable
Commitment	A.P.G. Filho et al. / Safety Science 48 (2010) 615–624	C-1	***Situational Aspect***	Audit program in work safety and environment	The organisation does not audit in safety at work	The organisation audits in safety at work only after serious accidents and work-related illnesses occur	The organisation has an auditing program in safety at work only in areaswhere risk of accident and work-related illness exist	The organisation has an auditing program in all the its sectors for safety at work	The organisation has an auditing program in all its sectors for both safety at work and nvironment
		C-2	***Situational Aspect***	The existence of OSH team in the company	The organisation does not have a team to give support in safety at work	The organisation has a small team to give support in safety at work	The organisation has a team that is big enough to give support in safety at work	The organisation has a team that is big enough to give support in safety at work	The organisation does not have a team to give support in safety at work specifically because the responsibility for it is shared by all the organisation members
		C-3	***Situational Aspect***	Importance of Safety at work	The organisation considers safety at work only as an expense	The organisation considers safety at work important only when serious accidents or work-related illnesses occur	The organisation considers safety at work important, but it emphasises production	The organisation seeks to prioritise safety at work, but it is not a reality yet	The organisation, in fact, prioritises safety at work and production equally
		…	,,,	,,,	,,,	,,,	,,,	…	,,,
		…	,,,	,,,	,,,	,,,	,,,	…	,,,

Appendix A Iteration 1 result of Safety Culture Maturity Level Framework (continuation)

Factor	Reference	ID	Aspect	Indicator	Level				
					Pathological	Reactive	Bureaucratic/Calculative	Proactive	Sustainable
Organisational Learning		…	…	…	…	…	…	…	…
		OL-9	***Psychological Aspect***	Company's planning to minimize the hazards	The company has not carefully done the planning to minimize hazards	The company carefully do the planning to minimize hazards after accident happened	The company carefully do the planning to avoid hazards to happen	The company carefully, systematically, and structured do the planning to prevent hazards to happen	The company carefully do the planning to prevent hazards to happen and coduct the review periodically
		OL-10	***Situational Aspect***	Conducting review of OSH Management System	The company does not conduct review to OSH Management System for improvement of work safety	The company does conduct review to OSH Management System for improvement of work safety when accident happened	The company does conduct review to OSH Management System for improvement of work safety to comply with the regulations	The company systematically and structured conduct review to OSH Management System for improvement of work safety	The company periodically conduct review to OSH Management System which is systemic and structured for improvement of work safety
	A.P.G. Filho et al. / Safety Science 48 (2010) 615–624	OL-11	***Behavioral Aspect***	The aim of analyzing unusual events	The analysis of unusual events aims to identify the guilty ones only	The analysis of unusual events aims to identify the cause of the events	The analysis of unusual events aims to identify the cause of the events and the guilty ones	The analysis of unusual events aims to identify the root cause of the events	The analysis of unusual events aims to identify the root cause of the events and give treatment to the guilty ones

Appendix B Aspect Weighting Questionnaire

K U E S I O N E R

TINGKAT KEPENTINGAN ASPEK BUDAYA AMAN DI PT SMART

Pada penelitian ini dibutuhkan pendapat dari **pakar (*expert)*** untuk **menentukan tingkat kepentingan** dalam penentuan ***safety culture maturity level***. Dalam konsep budaya keselamatan dalam organisasi, terdapat 3 variabel penyusun yaitu **Psychological, Behavioral, dan Situational Aspect**. Berikut merupakan penjelasan dari masing-masing variabel

Psychological Aspect	Behavioral Aspect	Situational Aspect
Nilai, sikap, perasaan, dan persepsi setiap individu dalam organisasi dalam memandang perihal K3 dalam organisasi	**Tindakan dan perilaku** individu yang berhubungan degnan komitmen baik karyawan maupun atasan dalam mengelola K3	**Hal-hal yang secara sistem diterapkan** oleh regulasi seperti kebijakan, prosedur, poster, slogan struktur organisasi, dan sistem manajemen

I. PETUNJUK PENGISIAN

*Berilah tanda centang (✔) pada **salah satu jawaban** (seperti gambar di bawah) yang anda anggap menggambarkan tingkat kepentingan satu variabel dengan variabel lainnya dengan mengacu pada tabel definisi nilai tingkat kepentingan*

Variabel	Nilai																	Variabel
A	8	7	6	5	4	3	2	1	0	1	2	3	4	5	✔ 6	7	8	B

Keterangan : Gambar diatas menunjukan bahwa variabel B memiliki intensitas lebih penting sebesar 6 dibandingkan variabel A. Artinya Variabel B sangat lebih penting dari variabel A

Intensitas Pentingnya	Definisi
0	**Sama penting**
2	Elemen A **sedikit lebih penting** dari elemen B
4	Elemen A **lebih penting** dari elemen B
6	Elemen A **sangat lebih penting** dari elemen B
8	Elemen A **mutlak lebih penting** dari elemen B
1, 3, 5, 7	Nilai diantara kedua angka terdekat

II. IDENTITAS RESPONDEN

Nama :

Jabatan :

III. PERTANYAAN

*Berilah tanda centang (✔) pada **salah satu jawaban** (seperti contoh) yang anda anggap menggambarkan tingkat kepentingan satu variabel dengan variabel lainnya dengan mengacu pada tabel definisi nilai tingkat kepentingan*

Variabel	Nilai																	Variabel
Behavioral	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8	Psycholo-gical
Situational	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8	Behavioral
Psycholo-gical	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8	Situational

Ttd.

.....

Appendix C Data recapitulation of questionnaire score result (Part 1)

		C					L				R				EI			
Respondent Identity		***Sit***	***Sit***	***Psy***	***Psy***	***Bhv***	***Bhv***	***Bhv***	***Psy***	***Sit***	***Psy***	***Bhv***	***Bhv***	***Bhv***	***Psy***	***Psy***	***Sit***	***Bhv***
No	Name	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Item 15	Item 16	Item 17
1	GBJ-1	4	3	5	4	5	5	4	4	5	4	5	4	4	5	5	5	5
2	GBJ-2	4	4	4	3	4	4	4	4	4	4	3	3	4	5	5	3	4
3	GBJ-3	4	4	5	4	4	4	5	5	5	4	5	5	5	5	5	5	5
4	GBJ-4	4	3	4	5	5	5	5	3	4	3	4	4	4	3	2	5	4
5	GBJ-5	4	5	5	5	5	4	4	5	2	4	3	3	3	5	2	5	5
6	GBJ-6	4	5	4	5	5	4	5	5	4	3	4	3	5	4	5	5	5
7	GBJ-7	4	5	3	3	3	3	5	3	5	4	4	4	4	4	5	5	3
8	GBJ-8	5	5	5	5	5	5	4	5	5	5	5	5	4	5	5	5	5
9	GBJ-9	4	3	3	3	5	4	3	3	3	5	1	3	1	3	3	4	3
10	GBJ-10	5	3	4	4	5	5	4	5	4	4	5	4	2	5	5	5	5
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
96	WB-4	5	5	4	5	4	3	5	5	5	3	5	4	4	4	5	4	5
97	WB-5	2	1	4	2	4	4	1	1	3	1	3	3	5	1	5	3	5
98	WB-6	5	5	5	4	4	5	4	5	5	5	5	5	5	5	5	4	5
99	WB-7	5	4	5	4	5	2	5	5	3	5	3	5	4	4	4	4	3
100	WB-8	4	5	5	5	5	3	2	5	5	5	5	5	5	5	4	5	5

Appendix C Data recapitulation of questionnaire score result (Part 2)

		RI					CO				IC				OL				
Respondent Identity		***Sit***	***Sit***	***Sit***	***Bhv***	***Psy***	***Sit***	***Sit***	***Psy***	***Psy***	***Psy***	***Sit***	***Psy***	***Sit***	***Bhv***	***Bhv***	***Bhv***	***Bhv***	***Sit***
No	Name	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25	Item 26	Item 27	Item 28	Item 29	Item 30	Item 31	Item 32	Item 33	Item 34	Item 35
1	GBJ-1	4	5	4	5	4	5	5	3	5	4	4	3	5	5	3	4	5	5
2	GBJ-2	3	4	3	3	4	3	4	3	4	4	4	3	5	5	3	3	3	3
3	GBJ-3	3	3	5	5	5	5	5	3	3	5	5	5	5	3	3	5	5	5
4	GBJ-4	4	3	4	3	3	4	4	5	5	4	4	3	5	4	2	2	5	2
5	GBJ-5	5	4	5	3	3	4	5	4	3	4	5	5	4	5	5	5	5	5
6	GBJ-6	4	3	3	4	4	4	5	5	3	4	4	3	5	5	4	4	5	5
7	GBJ-7	4	5	3	4	3	4	5	3	3	3	2	3	3	4	3	2	3	3
8	GBJ-8	5	3	5	5	5	5	5	2	5	5	5	5	5	5	5	5	5	5
9	GBJ-9	5	5	4	3	4	2	3	5	4	1	5	4	5	4	4	2	5	3
10	GBJ-10	5	3	5	3	3	4	5	5	3	4	4	3	3	4	3	5	5	5
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
96	WB-4	5	4	5	4	5	3	4	3	5	5	5	3	4	4	4	4	3	3
97	WB-5	1	2	2	3	4	3	4	3	2	1	4	3	1	2	3	4	5	3
98	WB-6	5	5	5	3	4	4	4	5	5	5	5	5	5	5	3	5	5	5
99	WB-7	5	4	5	5	5	3	4	4	4	5	5	5	3	5	4	2	5	5
100	WB-8	5	4	5	5	5	4	4	5	5	5	5	4	4	5	3	5	5	4

Appendix D Table r Pearson Correlation

TABLE A-6 Critical Values of the Pearson Correlation Coefficient r

n	$\alpha = .05$	$\alpha = .01$
4	.950	.999
5	.878	.959
6	.811	.917
7	.754	.875
8	.707	.834
9	.666	.798
10	.632	.765
11	.602	.735
12	.576	.708
13	.553	.684
14	.532	.661
15	.514	.641
16	.497	.623
17	.482	.606
18	.468	.590
19	.456	.575
20	.444	.561
25	.396	.505
30	.361	.463
35	.335	.430
40	.312	.402
45	.294	.378
50	.279	.361
60	.254	.330
70	.236	.305
80	.220	.286
90	.207	.269
100	.196	.256

NOTE: To test H_0: $\rho = 0$ against H_1: $\rho \neq 0$, reject H_0 if the absolute value of r is greater than the critical value in the table.

Source:http://www.doralacademyprep.org/ourpages/auto/2013/5/10/39534384/Table%20A-6.pdf

Appendix E Safety Culture Maturity Level Questionnaire

KUESIONER

ASSESSMENT TINGKAT KEMATANGAN BUDAYA KESELAMATAN DAN KESEHATAN KERJA PADA AKTIVITAS LOGISTIK (Studi Kasus: COMMERCIAL DEPARTMENT PT SMART Tbk.)

Kepada Yth.
Bapak/Ibu/Saudara Responden

Di Tempat

Saat ini saya sedang melakukan penelitian Tugas Akhir dengan judul "*Safety Culture Maturity Level Framework Development and Its Assessment in Logistic Activities"* atau Pengembangan framework pengukuran tingkat kematangan budaya K3 dan penilaiannya pada aktivitas logistik. Objek penelitian yang dipilih sebagai studi kasus merupakan Departemen Commercial PT SMART Tbk.
Dengan inisiatif penelitian ini diharapkan PT SMART Tbk. dapat mengetahui gap kematangan proses Budaya Keselamatan Kerja yang diharapkan dapat di formulasikan dalam bentuk Sistem Budaya K3 yang dapat di implementasi secara baik dan berkelanjutan; sehingga menciptakan transformasi perilaku K3 yang baik & unggul dari insan SMART dan dari lingkungan kerja di SMART.
Sehubungan dengan hal tersebut, bersama ini kami mohon kesediaan Bapak/Ibu/Saudara untuk membantu mengisi kuesioner ini. Apapun pendapat dan informasi yang Bapak/Ibu/Saudara berikan, **KAMI AKAN JAMIN KERAHASIAANNYA** dan ini semata-mata untuk kepentingan survey pemetaan. Oleh karena itu, Kami mohon Bapak/Ibu/Saudara dapat **MEMBERIKAN JAWABAN YANG OBJEKTIF SESUAI DENGAN KONDISI AKTUAL** di masing-masing bagian unit
. Atas perhatian dan kerjasama Bapak/Ibu/Saudara dalam pengisian kuesioner ini, Kami sampaikan terima kasih

Hormat saya,

Mohammad Iqbal K G

I. IDENTITAS RESPONDEN

Nama : .....

Usia : ☐ 18-26th ☐ 27-35th ☐ 36-44th ☐ 45-53th ☐ >53th

Jenis Kelamin : (L / P)

Daerah Asal : ..... (Kab/Kota)

Suku : .....

Pendidikan : ☐ SD ☐ SMP ☐ SMA ☐ D1 s.d D4 ☐ S1 s.d S3

Nama Perusahaan : ☐ PT. SMART Tbk. ☐ Outsource ☐ Lainnya...

Jabatan : ☐ Section Head ☐ Foreman ☐ Officer ☐ Lainnya...

Lama Bekerja : ☐ Kurang dari 1 tahun ☐ 1 - 5 tahun ☐ 5,1 - 10 tahun ☐ 10,1 – 15 tahun ☐ Lebih dari 15 tahun

Pelatihan K3 yang pernah diikuti : .....

Surabaya, ….. .....…...
2018

II. PETUNJUK PENGISIAN

*(Berilah tanda conteng (✔) pada **salah satu jawaban** yang saudara anggap paling sesuai)*

1. Jika terdapat kecelakaan atau insiden (kejadian nyaris celaka) pada lingkungan kerja, maka yang biasa kami lakukan adalah

Pilihan 1	✔ Pilihan 2	Pilihan 3	Pilihan 4	Pilihan 5

III. PERTANYAAN

1. (C) Berdasarkan pelaksanaan operasional di area kerja, apakah Perusahaan (Manajemen) **menetapkan aturan K3** dan berkomitmen untuk menjalankan aturan K3 yang diwujudkan **melalui sistem penghargaan dan hukuman** (*reward and punishment)* yang jelas?

Tidak menerapkan kebijakan aturan K3.	Menerapkan sistem hukuman setelah terjadi kecelakaan kerja.	Menerapkan sistem penghargaan dan hukuman pada area kerja yang berisiko tinggi.	Diterapkan pada seluruh area kerja dalam rangka meminimalkan kecelakaan kerja.	Tidak diperlukan sistem penghargaan dan hukuman karena karyawan sudah sangat termotivasi untuk menerapkan K3 di seluruh area kerja.

2. (C) Berdasarkan kenyataan yang terjadi di area kerja, apakah Perusahaan (Manajemen) telah **mempertimbangkan aspek keselamatan kerja saat melakukan kerjasama dengan pihak alih daya (*outsourcing*)**?

Dipetimbangkan sebagai bagian dari sistem keselamatan kerja yang telah memilki kesadaran tinggi mengenai pentingnya keselamatan kerja.	Dilakukan proses pre-kualifikasi dan dilakukan pengecekan yang sistematis saat pekerjaan berlangsung	Dilakukan proses pre-kualifikasi dengan mempertimbangkan aspek keselamatan kerja	Diperhatikan setelah terjadi kecelakaan kerja yang melibatkan perusahaan alih daya (*outsourcing)*.	Hanya mempertimbangkan aspek harga yang rendah.

3. (OL) Berdasarkan pengalaman Anda selama bekerja, seberapa sering Perusahaan (Manajemen) melakukan **analisa penyebab kejadian hampir celaka**/*near miss incident*?

Perusahaan tidak menganalisa	Menganalisa setelah terjadi kecelakaan berat.	Menganalisa pada area kerja dengan risiko kecelakaan yang tinggi.	Menganalisa pada area kerja dengan risiko kecelakaan tinggi dan medium saja.	Menganalisa semua tanpa terkecuali sebagai bahan pembelajaran dan pencegahan dikemudian hari.

4. (OL-11) Berdasarkan fakta dilapangan, apakah Perusahaan (Manajemen) melakukan **tinjauan SMK3 secara berkala untuk perbaikan dan penguatan keselamatan kerja**?

Perusahaan tidak melakukan tinjauan SMK3	Perusahaan melakukan tinjauan setelah terjadi kecelakaan kerja.	Melakukan tinjauan karena merupakan aturan dari Perusahaan.	Melakukan tinjauan secara sistematis (terjadwal, teratur)	Melakukan tinjauan secara sistematis dan evaluasi berkala.

Terima kasih atas partisipasi Anda. Semoga iklim budaya K3 di SMART menjadi lebih baik.

BIOGRAPHY

Mohammad Iqbal Kinasih Gusti was born in Kediri, April 21st 1995. Formal education was done by author in SD Muhammadiyah 1 Ngadiluwih, SMPN Sragen Bilingual Boarding School, SMAN Sragen Bilingual Boarding School, and in Industrial Engineering Department Institut Teknologi Sepuluh Nopember Surabaya.

Other than attending college, author also join several activities such as event organizer, organization, and training. Author was a Staff of Communication and Information Department at HMTI ITS 2015/2016 and BEM FTI ITS 2015/2016, Staff of ITS Expo 2015, Head Communication and Information HMTI ITS 2016/2017, Expert Staff of ITS Expo 2016.

Several training have been followed by author such as Latihan Keterampilan Manajemen Mahasiswa Pra-TD, Basic Media Schooling and Netlogo Training. The author have professional work experiences as the tutor of Informatics Olympiad in Erick Institute and OSN Training Center as well as internship at PT Amman Mineral Nusa Tenggara. Now, author lives in Kediri. Contact author via email to mi.kinasihgusti@gmail.com.